Rock Products

With which is Incorporated **CEMENT and ENGINEERING NEWS** Founded 1896

Chicago, February 18, 1928 (*Issued Every Other Week*) Volume XXXI, No. 4

Hercules
ENGINES

ANOTHER outstanding example of Hercules reliability applied to power excavating machinery.

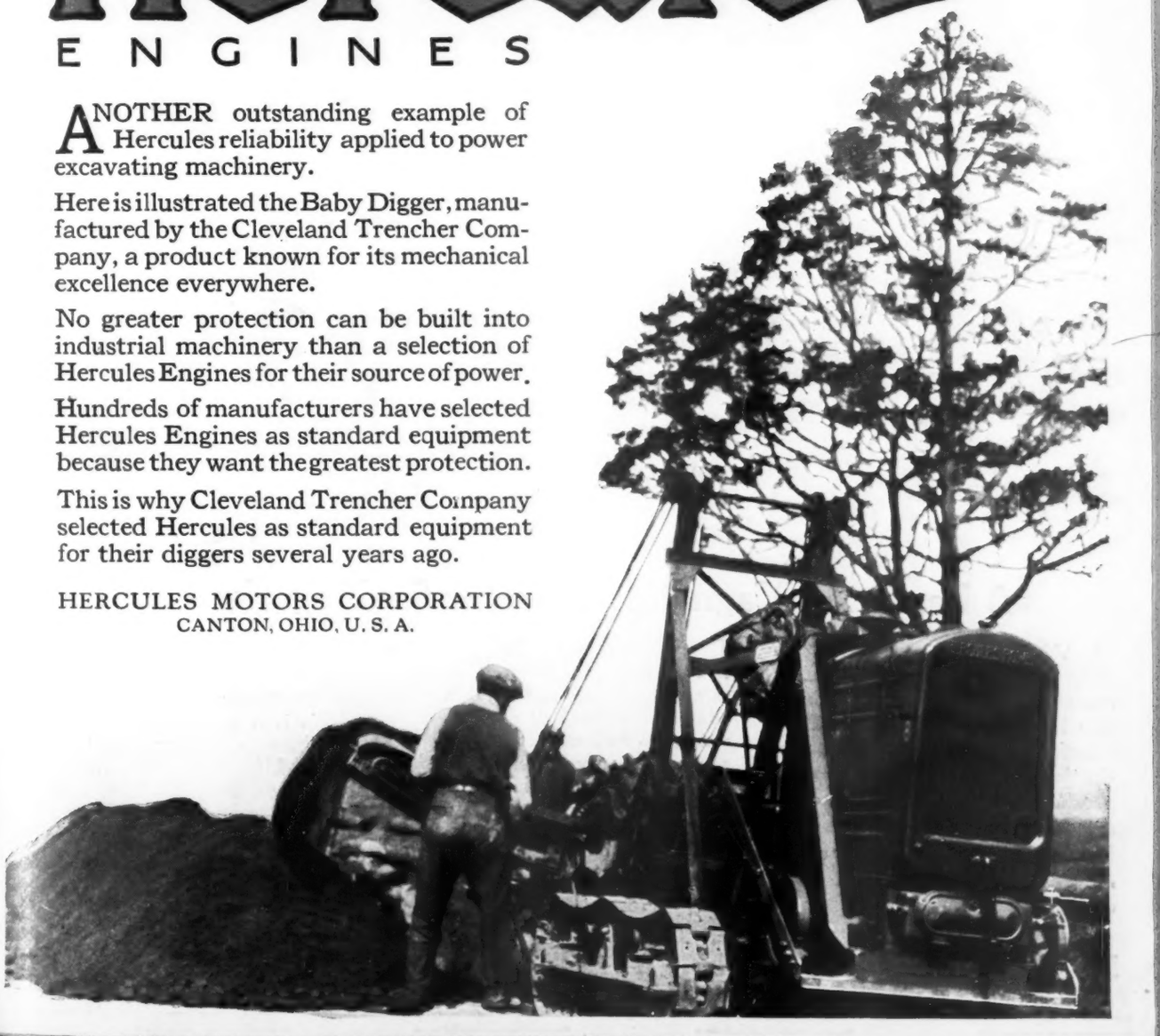
Here is illustrated the Baby Digger, manufactured by the Cleveland Trencher Company, a product known for its mechanical excellence everywhere.

No greater protection can be built into industrial machinery than a selection of Hercules Engines for their source of power.

Hundreds of manufacturers have selected Hercules Engines as standard equipment because they want the greatest protection.

This is why Cleveland Trencher Company selected Hercules as standard equipment for their diggers several years ago.

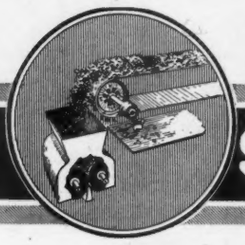
HERCULES MOTORS CORPORATION
CANTON, OHIO, U. S. A.



MEMBER A. B. C. *The Only Paid Circulation covering the Rock Products Industry* MEMBER A. B. P.

Printing of This Issue Is 5350 Copies. Next Issue Will Be March 3

HIGH DUTY Magnetic Separators



Now

Write us for complete description of this High Duty Magnetic Separator, explaining construction and operation.

A Perfected Magnetic Separator for Pulverized Slag

A VARIABLE iron content in the pulverized slag used in cement manufacture by the Superior Portland Cement Co., Ohio, interfered seriously with the production of a high grade finished product. Some means of handling and separating the iron content from the slag, moving at the rate of forty tons per hour, had to be devised.

The problem was submitted to the Magnetic Mfg. Co. and after thorough investigation, the High Duty Magnetic Separator shown above was designed and installed. The apparatus proved very successful, eliminating all difficulties previously experienced and assuring the manufacture of a uniformly high grade finished product. It is said that the amount of iron removed from the slag will very shortly pay the cost of the installation, as this iron can be profitably disposed of.

This is a representative example of the service offered by the Magnetic Mfg. Company. If this installation interests you, write us for the complete facts, and put your own magnetic separation problems up to us—thirty years' experience designing and building magnetic equipment.

MAGNETIC MANUFACTURING CO., 279 23d Ave., Milwaukee, Wisconsin

ROTEX

for Screening Wet or Dry

THE design of the ROTEX Screen is such as to make it adaptable for handling practically any screenable material, either wet or dry. Installations of the Heavy Duty type are today successfully screening materials such as crushed rock, crushed shell, sand, gravel, slag, refractory, phosphate rock, etc., through meshes principally between 16 to the inch and 1-inch opening.

A good example of a very difficult material which is being readily handled by the machine illustrated below, is the screening of ground bone and meat scrap through 20 mesh wire cloth. This use is here cited merely to show how the ROTEX mesh cleaning system is solving the screening of fine and sticky products. Accuracy and speed of separation are also very much appreciated qualities of ROTEX operation.

For dewatering or washing the peculiar flat gyratory motion of the ROTEX screen surface produces an effect that cannot be equaled in a screen of ordinary design. The material lays at a greater depth as it travels along, with the result that the maximum washing effect is secured with a minimum amount of water.

Though washing is one phase of screening in which the ROTEX excels, it is not by any means limited to wet operations. When it comes to large capacity and accurate separations in the screening of dry materials the ROTEX is a unit unequaled for efficiency.

The reputation which the ROTEX has acquired for rapid screening is largely due to the patented method employed for keeping the meshes always open. This method is the exclusive "solid-rubber-ball-and-bevel-strip" mesh cleaning system—consisting of a large number of rubber balls confined in pockets under the screen cloth, which are constantly deflected upwards so as to keep the meshes always open by ***direct pounding contact.***

Accurate separations result from the nearly level position of the screen surface. The screen frame moves in a large level circular path which slides the material rapidly over the surface—yet retaining it long enough to insure absolute accuracy.

This is the ROTEX Heavy Duty Screen No. 14 which has a single surface 4 ft. by 8 ft. Style No. 18 has two decks, each 4 ft. by 6 ft. Write for the new ROTEX catalog No. 81.

The
ORVILLE SIMPSON COMPANY
Office and Factory
1221 KNOWLTON ST. CINCINNATI, OHIO

The Only Paid Circulation Covering the Rock Products Industry

Rock Products

With which is Incorporated CEMENT and ENGINEERING NEWS Founded 1896

Entered as second-class matter, July 2, 1907, at the Chicago, Ill., postoffice under the Act of March 3, 1879. Copyrighted, 1926, by Tradepress Publishing Corporation.

Contents for February 18, 1928

Dredging Sand at St. Louis, Mo. **49-53**
Mississippi River Sand and Material Co.'s principal market in close proximity to its operation and plant.

Silica Sand Plants at Ottawa, Ill. **54-60**
General practices in one of the largest producing areas in the United States.

Practice vs. Possibility in the Cement Manufacturing Industry **61-65**
Some random comments by an operating man. By H. H. Blaise.

Lime Burning Practice Based on European and American Observations **66-67**
Part II.—Heat distribution in lime kilns, gas flow, lime flow; causes of irregular flow. By Victor J. Azbe.

Quarrying and Manufacture of Slate **68-73**
Colonial Slate Co.'s mill at Wind Gap, Penn., a fine example of what can be done to modernize manufacture of slate products. By J. R. Thoenen.

Safety First in Large Scale Blasting Operations **76-77**
Precautions in using power current on explosives. By W. L. Home.

Technology of Gypsum Plaster Materials **78-80**
Part I.—Effects of calcination temperatures on properties of gypsum—nature and utilization of anhydrous and dead-burned gypsum.

Sand-Lime Brick Association Meets at Washington, D. C. **85-89**
Program covers many current problems both within and without the industry.

The Evolution of Track on American Railways **92-93**
As depicted in exhibits displayed at the centenary exhibition of the Baltimore and Ohio R. R. at Halethorpe, Md.

Departments

Hints and Helps for Superintendents **74, 75**
Editorial Comment **81**
Financial News and Comment **82, 83, 84**
Sand-Lime Brick in January **91**
Foreign Abstracts **94, 95**
Traffic and Transportation News **96, 97**
News of the Industry **98, 99, 109, 112**
Current Prices of Rock Products **100-104**
Cement Products **105-108**
New Machinery and Equipment **110, 111**
News of All the Industries **112, 114**
Classified Directory of Advertisers **124-130**

THE TRADEPRESS PUBLISHING CORPORATION
542 South Dearborn Street, Chicago, Illinois, U. S. A.
W. D. CALLENDER, *President*
N. C. ROCKWOOD, *Vice-President* C. O. NELSON, *Secretary*

LONDON OFFICE: Dorland House, Mezzanine Floor, 14 Regent St., S. W. I.

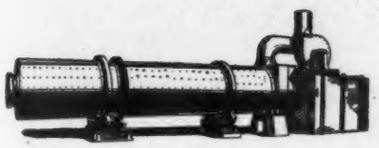
NATHAN C. ROCKWOOD, *Editor and Manager*
EDMUND SHAW, *Editor*
JOHN J. LANDY, *Assistant Editor*
HORATIO M. FITCH, *Assistant Editor*
J. M. COX, *Manager, Research and Service Department*
E. A. SINE, *Production Manager*
GLENN BEAVERS, *Manager, Advertising Copy Department*

SUBSCRIPTION—Two dollars a year to United States and Possessions. Three dollars a year to Canada and foreign countries. Twenty-five cents for single copies.

GEORGE M. EARNSHAW, *Eastern Advertising Manager*
FRED S. PETERS, *Eastern Representative*
280 Madison Ave., New York City. Tel. Caledonia 4474
WALTER E. EDWARDS, *Central Advertising Manager*
528 Leader Bldg., Cleveland. Tel. Main 4056
RALPH C. SULLIVAN, *Advertising Manager*
FRANKLIN A. ALTER, W. A. WILSON, *Western Representatives*
Chicago. Tel. Wabash 3714-3715

TO SUBSCRIBERS—Date on wrapper indicates issue with which your subscription expires. In writing, to have address changed, give old as well as new address.

The A. B. P. is a nonprofit organization whose members have pledged themselves to a working code of practice in which the interests of the men of American industry, trade and professions are placed first—a code demanding unbiased editorial pages, classified and verified paid subscribers, and honest advertising of dependable products.



Dry
Before You Pulverize

And give yourself the margin of safety in your plant operation that is the difference between knowing what you are up against, and not knowing what to expect from new or untried methods.

With a Ruggles-Coles Dryer, the purchaser knows before he buys exactly what it will cost him to operate. Recommendations are backed up by actual operating records covering a period of over 30 years, and covering practically every known material to be dried.

While the initial cost of a dryer may seem high, the cost of drying is definitely known, operating conditions are accurately controlled, and no product is wasted by untried methods.

Write for information

Ruggles-Coles Engineering Company
of Hardinge Company, Inc.
York, Pa.

120 Broadway
New York, N. Y.

Continental Bank Bldg.
Salt Lake City

"Ruggles-Coles" Dryers

When writing advertisers, please mention ROCK PRODUCTS

Prest-O-Weld pays for itself

How soon will this piece of equipment pay for itself?

Whether you use Prest-O-Weld for repair or construction work you need only five good jobs, that you formerly could not do or had to have done outside, to make this equipment pay for itself.

It is therefore not so much a question of whether you can afford a Prest-O-Weld kit as whether you can afford to be without one.

OXWELD ACETYLENE COMPANY

Unit of Union Carbide and Carbon Corporation

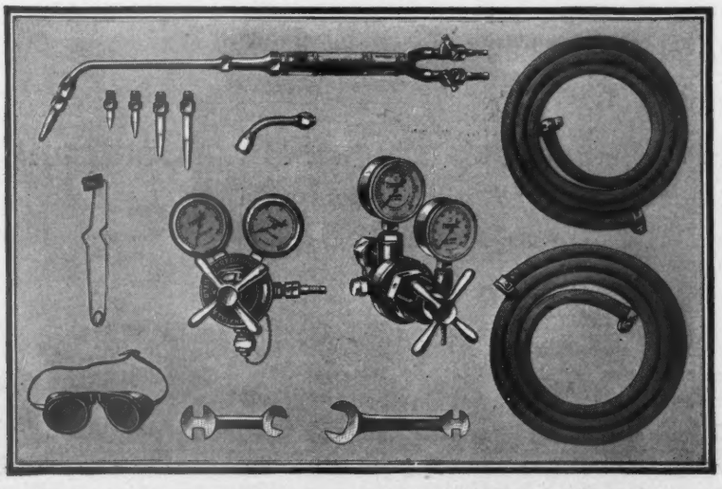
UCC

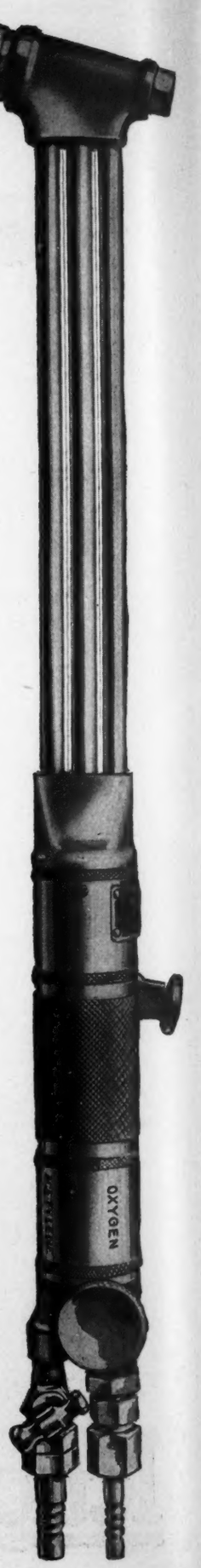
Chicago
3642 Jasper Place

Long Island City, N. Y.
Thompson Ave. & Orton St.

San Francisco
8th and Brannon Sts.

PREST-O-WELD





Longlife Conveyor Belt is now BETTER THAN EVER!

Here are some typical records made by Longlife belts manufactured years ago:

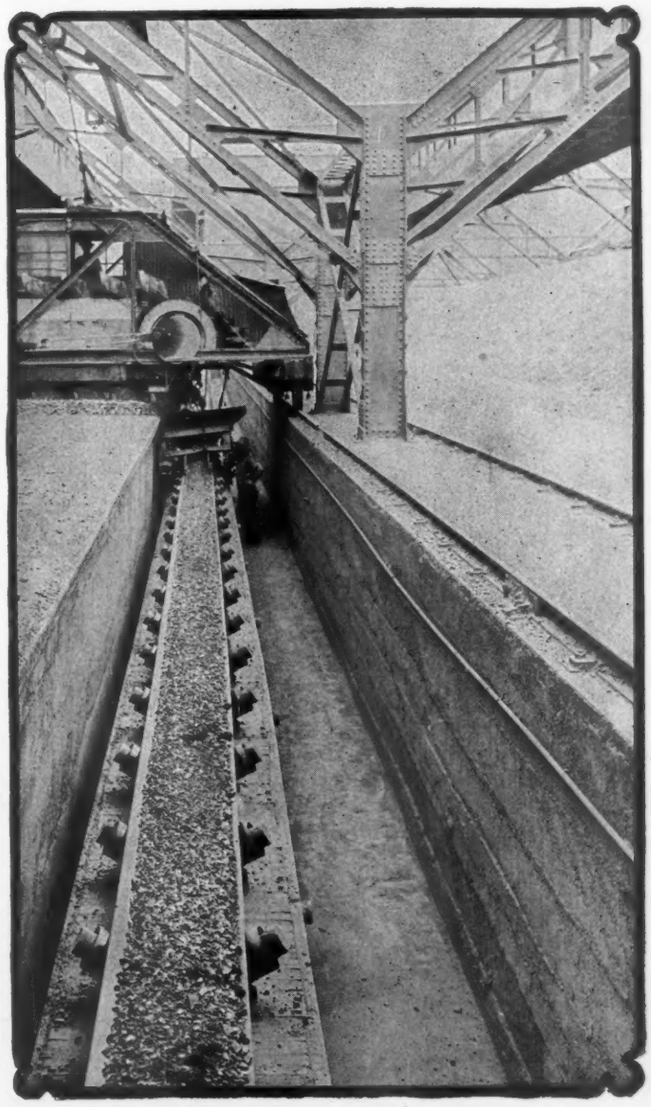
A copper mine in South America installed two 48", 9-ply Longlife belts in 1921. These two belts have moved *twenty-five million* tons of ore 580 feet at a belt-cost of only $.000465 per ton, and are still in service.

When he ordered a 48", 9-ply Longlife belt, the superintendent of an Ohio lime and stone plant said he would be satisfied if it lasted three years. It actually served seven years and one month.

A smelting and refining company in Utah received 2,215 days' service from a 20", 6-ply Longlife belt.

Another large copper company, after holding a 32", 8-ply Longlife belt in the warehouse for *three years*, put it in service four years ago. It is still in fine condition.

The belt illustrated here, is a 20", 6-ply, carrying ore in a Southwestern smelter—150 tons per hour at a belt-cost of $0.0014.



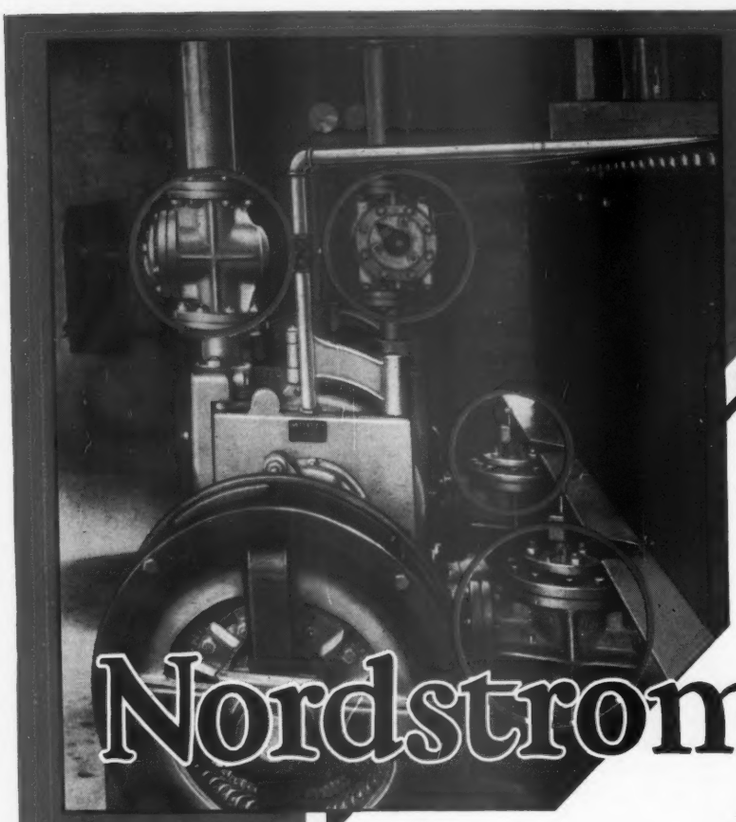
Longlife conveyor belt, as made today, is even better. The abrasion-resisting strength of the cover has been increased more than 100%, and the edge has been reinforced and secured inseparably to the body of the belt by the new Highflex bonded construction.

For endurance—for low belt-cost over long periods—specify Goodrich Longlife conveyor belt.

The B. F. Goodrich Rubber Company, Akron, Ohio

Established 1870

Goodrich *Rubber Products*

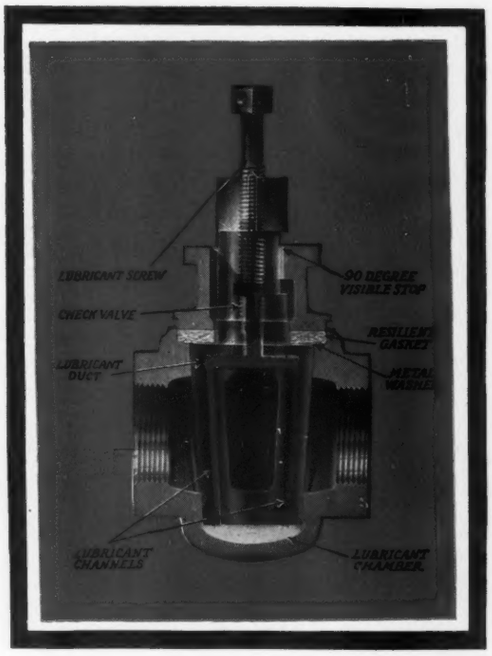


Merco Nordstrom Valves

NORDSTROM Valves are today regarded as indispensable for the successful operation of slurry lines in wet process cement plants. Perfect valve action and consequent ease of control—direct results of the principle upon which these valves operate—have made them practically standard practice in wet process plants built during the past several years.

Nordstrom Valves ***won't stick.*** Therein lies their advantage in slurry handling. Also, they are equally adaptable and widely used on steam, water, gas, oil and air lines.

Furnished in all sizes from 1/2 in. to 24 in.



MERCO NORDSTROM VALVE COMPANY

SUBSIDIARY OF THE MERRILL COMPANY

Engineers—Manufacturers

San Francisco, 121 Second St. — New York, 11 W. 42nd St. — Chicago, Peoples Gas Bldg. — Houston, 1315 Petroleum Bldg. — Cleveland, 325 Engineers Bldg.

Agencies in Principal Cities

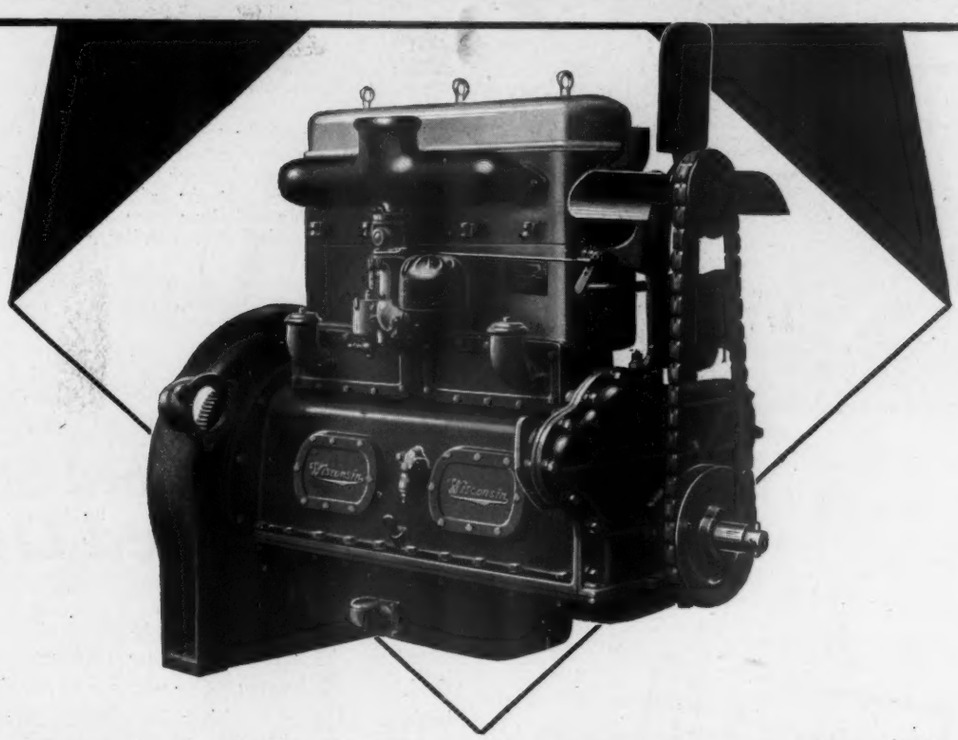
1501 Masonic Temple Bldg., New Orleans

Factories: Belleville, N. J.; Oakland, California

When writing advertisers, please mention ROCK PRODUCTS

MORE POWER per CUBIC INCH

Buy-word for Economical Power



"Wisconsin"—the name itself is a guaranty of dependable power at lowest cost.

Whether your needs are for industrial machinery, tractors, or trucks, see that the power comes from a Wisconsin motor. You, too, will then experience the savings and satisfaction that other owners of Wisconsin-powered products have enjoyed for years.

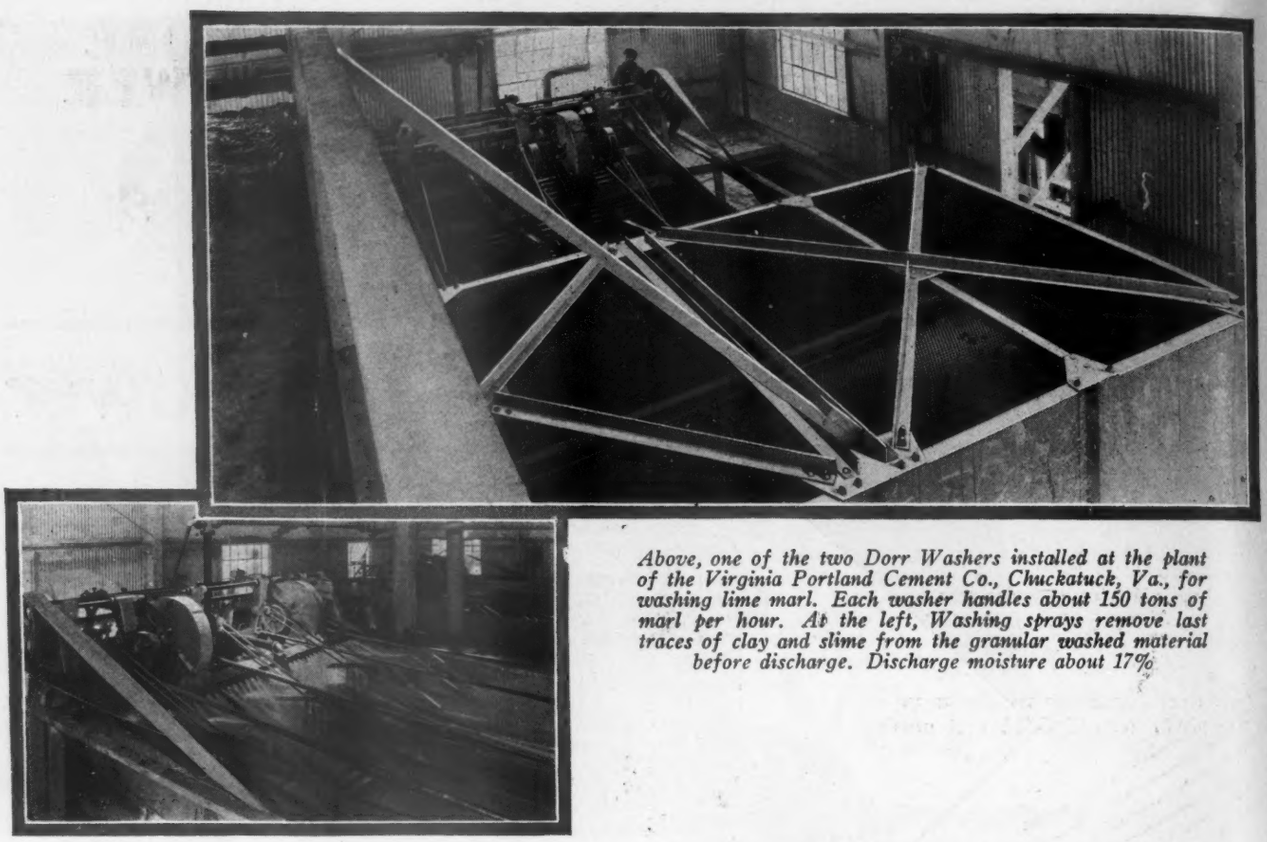
The savings come from Wisconsin's "More Power per Cubic Inch." The satisfaction is in the form of freedom from costly lay-ups for repairs and breakdowns —and in the ability of these great motors to do vast amounts of work on surprisingly low fuel and oil consumption.

May we convince you with the facts and figures?

WISCONSIN MOTOR COMPANY
Milwaukee, Wisconsin

Wisconsin Motors are manufactured in a full line of Sizes and Fours, with power range from 20 to 150 H.P. for construction machinery, trucks, busses and tractors.

Wisconsin CONSISTENT



Above, one of the two Dorr Washers installed at the plant of the Virginia Portland Cement Co., Chuckatuck, Va., for washing lime marl. Each washer handles about 150 tons of marl per hour. At the left, Washing sprays remove last traces of clay and slime from the granular washed material before discharge. Discharge moisture about 17%

Gravel and Crushed Stone -Washed Clean!

We also manufacture the Dorrco Sand Washer. If you did not see this machine demonstrated at the Detroit Convention, write for Bulletin No. 4171.

DORRCO

If you are having trouble producing consistently clean gravel or crushed stone products, the Dorr Washer can help you. The vigorous scouring action obtained in the washing barrel of this machine scrubs off the adhering silt, clay and fine material, and the gravel or coarse stone is discharged in a clean, drained condition.

The material that passes through the perforations in the washing barrel is further separated into a clean, low-moisture sand product, and a silt and clay overflow.

Our Bulletin No. 4071 describes the operation of the Dorr Washer in detail. Write to our nearest office for a copy.

THE DORR COMPANY

ENGINEERS

247 PARK AVENUE NEW YORK CITY

DENVER
1009 17th St
LOS ANGELES
108-W 6th St
WILKES-BARRE
536 Miners Bank Bldg

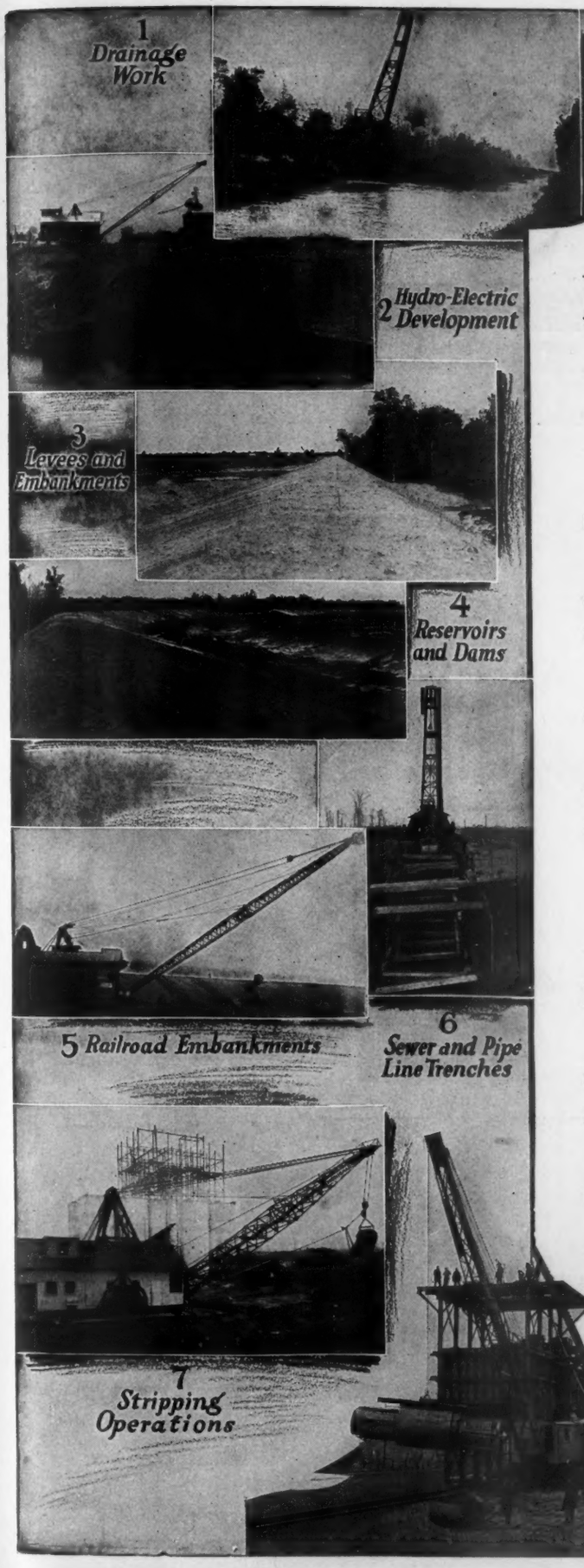
CHICAGO
310 S Michigan Ave
ATLANTA
1503 Candler Bldg
JOPLIN
319 Joplin National Bank Bldg

THE DORR CO. LTD.
16 South Street, London E C 2

TORONTO 330 Bay St
DORR G.m.b.H.
Joachimsthalerstr 10 Berlin W 15

SOC. DORR et CIE.
126 Rue de Provence Paris 8

INVESTIGATION TESTS DESIGN EQUIPMENT



Keeps Its New Year's Resolutions

THE Monighan Walking Dragline Excavator sets its own unsurpassed standard of daily capacity and *keeps* this standard.

It moves and works on surfaces that are marshy from heavy rainfall.

It makes sharp angle turns and completely changes its course without loss of travel.

It side-steps obstructions.

It digs wide cuts with a short boom.

And the same Monighan is used for both stripping and loading.

"You can't beat it"—that's why some contractors have sixteen Monighans at work.

MONIGHAN MACHINE CO.
949 N. Kilpatrick Ave. Chicago, Ill.

MONIGHAN

You see so many quarrymen putting in larger machines WHY?

Even when you visit so-called "small quarries," you see many of them using 2-yd., 3-yd., and 4-yd. shovels.

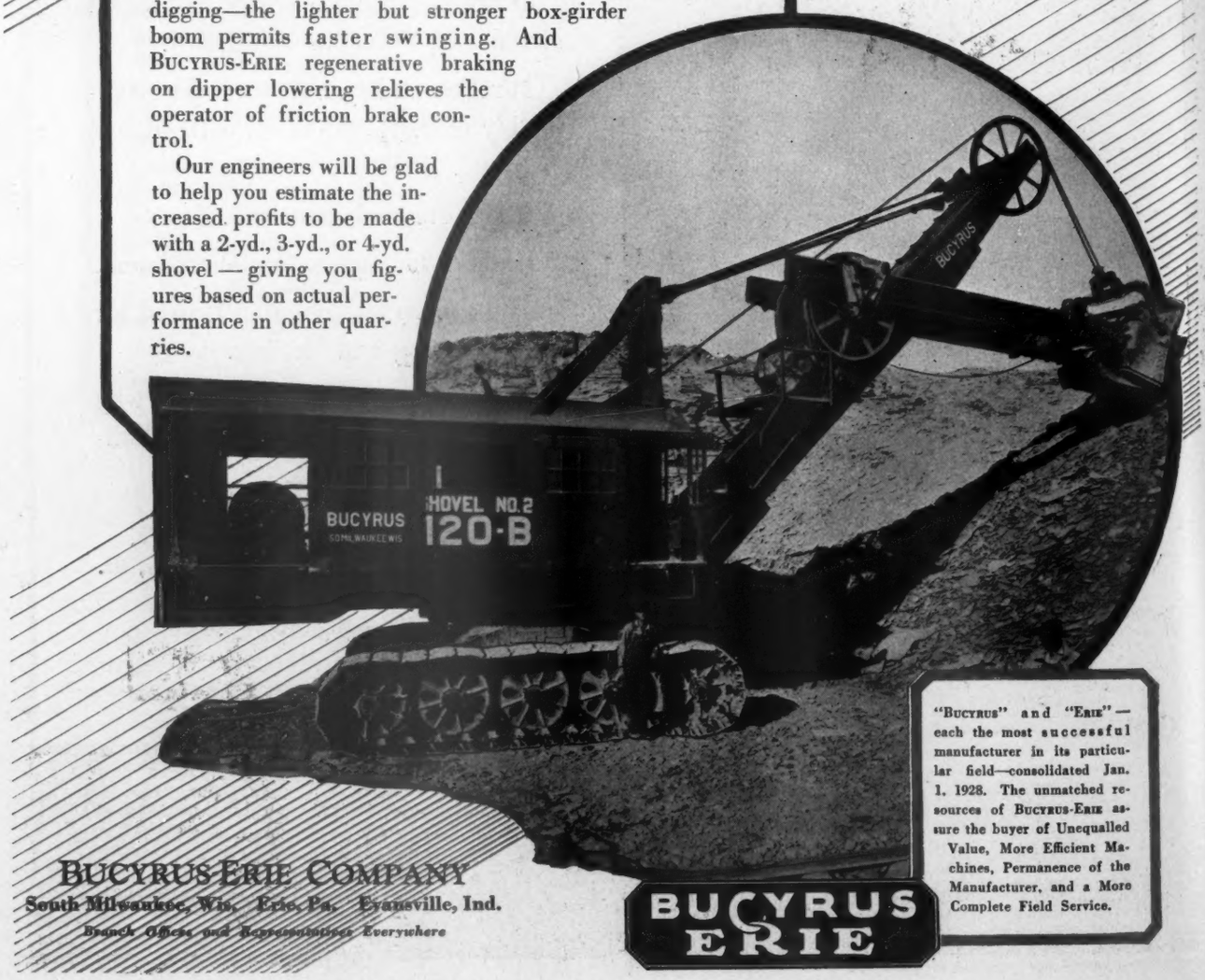
There's a strong trend toward *larger machinery units*, and it's easy to see why:

(1) Much lower cost-per-ton for rock loaded.
(2) More economical hauling, with a more simple trackage.
(3) Lower cost for shovel upkeep—with a wider margin of dependability.
(4) Extra capacity to take care of rush orders.

When you're putting in 2, 3 or 4-yd. revolving shovels, the extra speed of the BUCYRUS-ERIE gives an added advantage. Ample power with a single-line hoist means faster digging—the lighter but stronger box-girder boom permits faster swinging. And BUCYRUS-ERIE regenerative braking on dipper lowering relieves the operator of friction brake control.

Our engineers will be glad to help you estimate the increased profits to be made with a 2-yd., 3-yd., or 4-yd. shovel — giving you figures based on actual performance in other quarries.

The most successful companies have found that *operating on a big production basis* produces larger profits. And if your quarry has electric power on tap, these large revolving shovels will show even better economy. The shovel shown is a 120-B Electric (3-motor) BUCYRUS-ERIE.

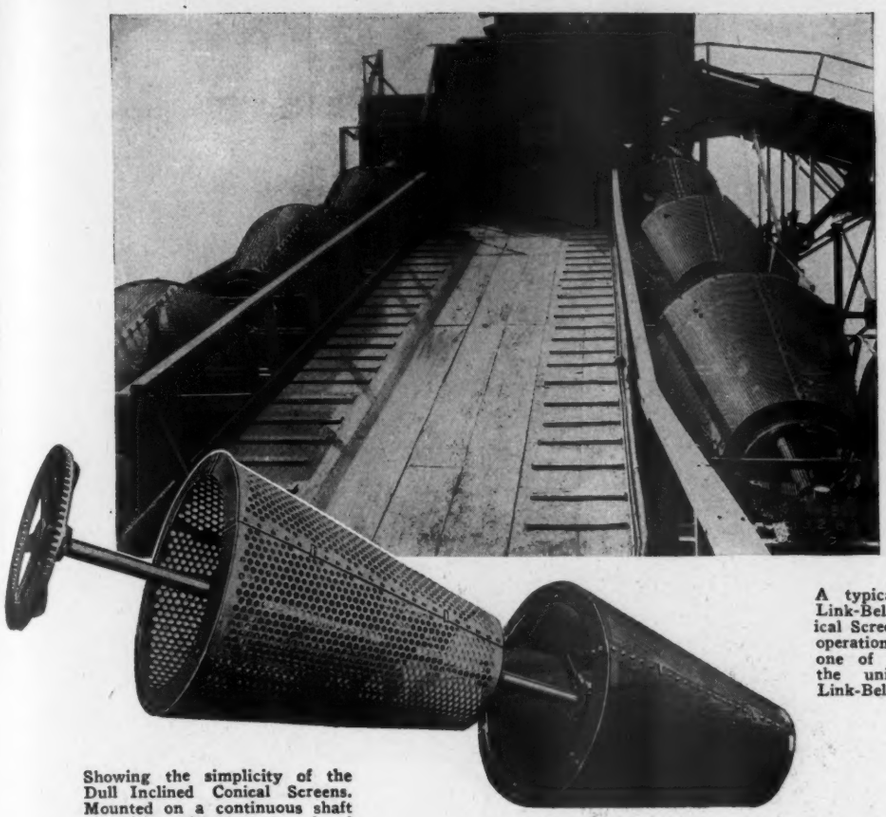


"BUCYRUS" and "ERIE"—each the most successful manufacturer in its particular field—consolidated Jan. 1, 1928. The unmatched resources of BUCYRUS-ERIE assure the buyer of Unequalled Value, More Efficient Machines, Permanence of the Manufacturer, and a More Complete Field Service.

BUCYRUS-ERIE COMPANY
South Milwaukee, Wis. Erie, Pa. Evansville, Ind.
Branch Offices and Representatives Everywhere

BUCYRUS ERIE

A 100% Record of Satisfaction



Showing the simplicity of the Dull Inclined Conical Screens. Mounted on a continuous shaft and driven by angle or bevel gears at one end.

A typical installation of Link-Belt Dull Incline Conical Screens. The satisfactory operation of these screens is one of the big factors in the universal success of Link-Belt Sand and Gravel Plants.

Link-Belt Products

Elevators and Conveyors for all purposes
Track Hoppers
Crushers
Skip Hoists
Power Hoes
Weigh Larries
Coal Bunkers
Water Intake Screens
Gondola Car Dumpers
Crawler Cranes
Locomotive Cranes
Chains, Wheels, Buckets
Transmission Machinery

Send for catalogs.

THE Dull Inclined Conical Screen operates just the reverse of ordinary screening processes. A large percentage of the feed is immediately passed over the large openings of the first screen, thereby reducing the load on the finer screens. The result is high screening efficiency, with less power required to operate; and low maintenance costs.

Complete plants and equipment for handling and preparing sand and gravel.

Write for Book No. 540, covering the complete Link-Belt line for Sand and Gravel Plants.

3124

LINK-BELT COMPANY

Leading Manufacturers of Elevating, Conveying, and Power Transmission Chains and Machinery

CHICAGO, 300 W. Pershing Road — INDIANAPOLIS, 200 S. Belmont Ave. — PHILADELPHIA, 2045 Hunting Park Ave.

Atlanta - - - - - 511 Haas-Howell Bldg.
Baltimore, Md., R. 800, Maryland Trust Bldg.
Birmingham, Ala. - 229 Brown-Marx Bldg.
Boston - - - - - - 1163-4 Statler Bldg.
Buffalo - - - - - 554 Ellicott Square
Cleveland - - - - 527 Rockefeller Bldg.
Dallas, Texas, 1221 Mercantile Bank Bldg.
Denver - - - - - - 520 Boston Bldg.
Detroit - - - - - 5938 Linsdale Ave.
Huntington, W. Va. Robson-Prichard Bldg.
Kansas City, Mo., R. 436, 1002 Baltimore Ave.
Louisville, Ky. - - - - 349 Starks Bldg.
Milwaukee Room 1403, 425 E. Water St.
New Orleans - - - - - 611 S. Peters St.
New York- - 2676 Woolworth Bldg.
Pittsburgh - - - - - - 335 Fifth Ave.
St. Louis - - - - - - - 3638 Olive St.
Utica, N. Y. - - - - 131 Genesee St.
Wilkes-Barre - 826 Second Nat'l Bank Bldg.

H. W. CALDWELL & SON CO.:—Chicago, Western Ave., 17th and 18th Sts.; New York, 2676 Woolworth Bldg.

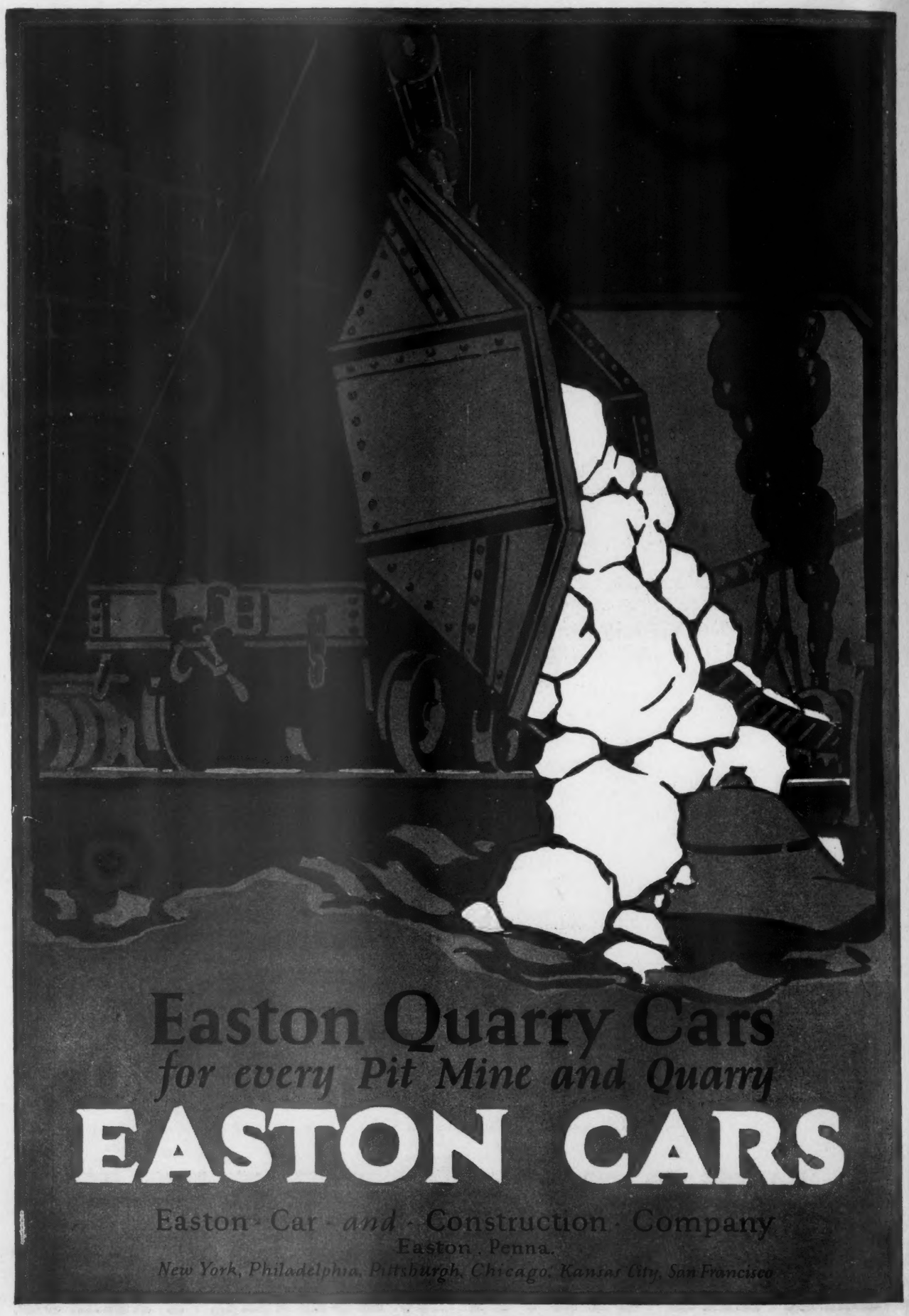
LINK-BELT MEESE & GOTTFRIED CO.:—San Francisco, 19th and Harrison Sts.; Los Angeles, 361-369 S. Anderson St.; Seattle, 820 First Ave., S.; Portland, Ore., 67 Front St.; Oakland, Calif., 526 Third St.

In Canada—LINK-BELT LIMITED—Toronto; Montreal; Elmira, Ont.

LINK-BELT

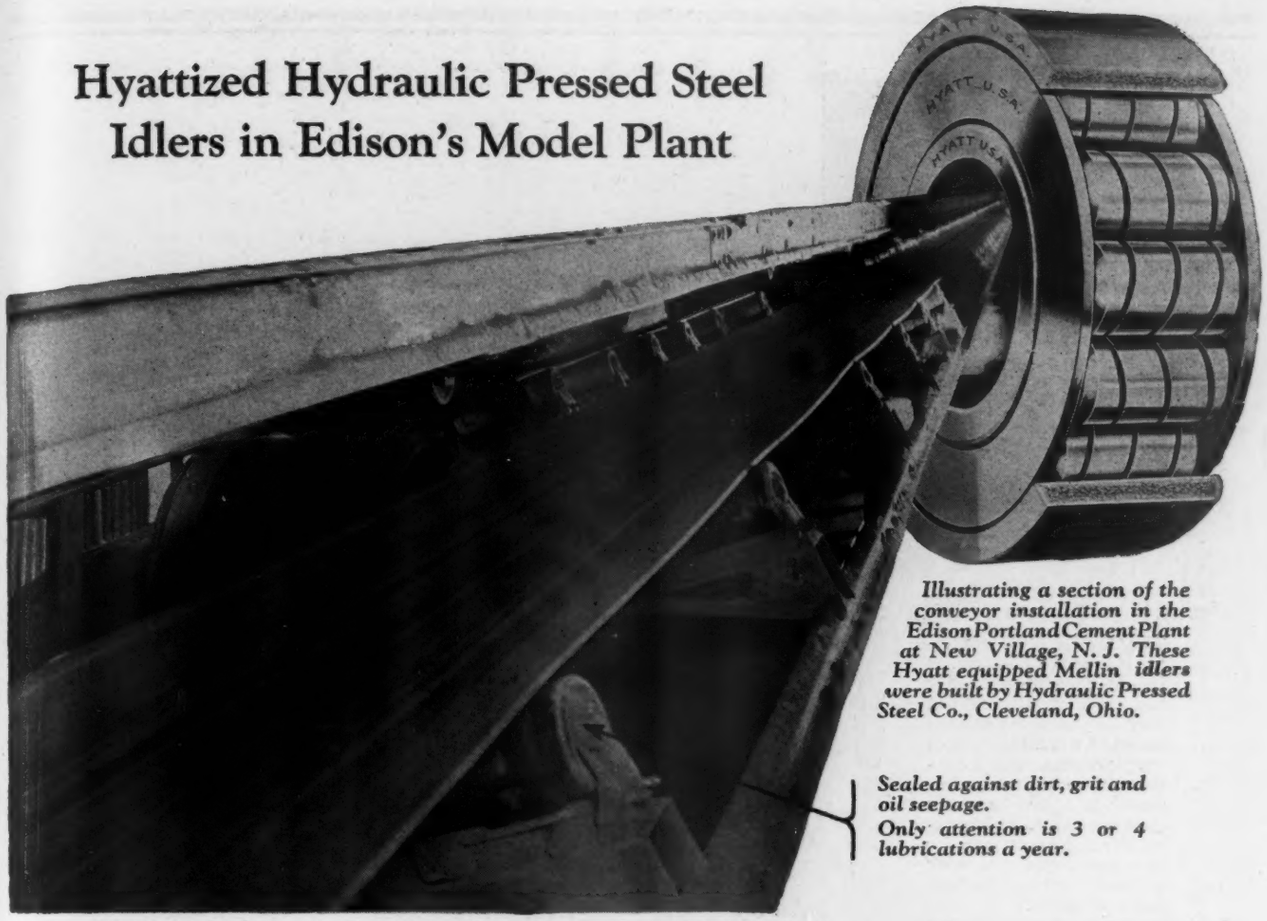
Sand and Gravel Washing Plants

When writing advertisers, please mention ROCK PRODUCTS


Easton Quarry Cars
for every Pit Mine and Quarry
EASTON CARS
Easton Car and Construction Company
Easton, Penna.
New York, Philadelphia, Pittsburgh, Chicago, Kansas City, San Francisco

When writing advertisers, please mention ROCK PRODUCTS

Hyattized Hydraulic Pressed Steel Idlers in Edison's Model Plant



Illustrating a section of the conveyor installation in the Edison Portland Cement Plant at New Village, N. J. These Hyatt equipped Mellin idlers were built by Hydraulic Pressed Steel Co., Cleveland, Ohio.

Sealed against dirt, grit and oil seepage.
Only attention is 3 or 4 lubrications a year.

YEARS of unwavering bearing satisfaction is Hyatt's regular contribution wherever applied.

Ordinary bearings that cost almost as much to install, cost more in a short time because they require so much attention. They frequently heat, stick and call for lubricant, adjustment or replacement — meanwhile holding up production and adding to maintenance expense.

Hyatts, in contrast, need no repairs or replacements. They roll with watch-like precision—yet quickly adjust themselves to the irregularities of the conveyors and their loads. They relieve the strain of starting loads—they prolong belt life.

In addition to their application in cement mill equipment, Hyatts in screens, shovels, locomotives, cars, drills and other quarry equipment are giving the same smooth, economical, lasting service.

HYATT ROLLER BEARING COMPANY

Newark Detroit Chicago Pittsburgh Oakland

HYATT

ROLLER BEARINGS

PRODUCT OF GENERAL MOTORS

When writing advertisers, please mention ROCK PRODUCTS

The Oxweld R-27 regulator is made of 23 parts. It is doing the same work that the older regulators did with 33 parts. Its success is due to a combination of simple design, rugged construction and careful workmanship. It is not a nozzle type regulator. It has exceptional flow capacity for this reason and will work without freezing. Several years of service in both high and low temperatures have shown it to be simple, sturdy and reliably accurate.

"Continuous" oxy-acetylene regulation

THE AVERAGE MECHANIC can take the Oxweld R-27 regulator to pieces, put in new parts and completely reassemble it in a few minutes.

This sounds like a trick stunt, but it isn't. It illustrates dramatically the simplicity of design of these gas regulators for oxy-acetylene welding and cutting.

Just think it over. After a certain period of service the regulator seat needs to be replaced. That's what happens in any regulator. It usually happens at a time when it is most inconvenient. Yet with the R-27 regulator you can have a reconditioned unit in a few minutes, at a cost of a few cents. In fact, the whole "inside works" costs only $3.60.

Unless you like to have your mechanics spending time on tools instead of productive work, Oxweld R-27 regulators are an economy that you can not overlook.

The R-27 regulator is a typical piece of Oxweld equipment. Oxweld customers need no other recommendation.

OXWELD ACETYLENE COMPANY
Unit of Union Carbide and Carbon Corporation

UCC

CHICAGO 3642 Jasper Pl. | LONG ISLAND CITY, N. Y. Thompson Ave. and Orton St. | SAN FRANCISCO 8th and Brannon Sts.

STOCKS IN 41 CITIES
In Canada: Dominion Oxygen Co., Ltd., Toronto

Oxweld
WELDING AND CUTTING APPARATUS

UTILITY

A useful product is not just a happening but the result of years of patient, careful effort. Prest-O-Lite dissolved acetylene has been on the market for twenty-three years, with an ever-increasing volume of sales. That is proof of utility.

THE PREST-O-LITE COMPANY, INC.

Unit of Union Carbide and Carbon Corporation

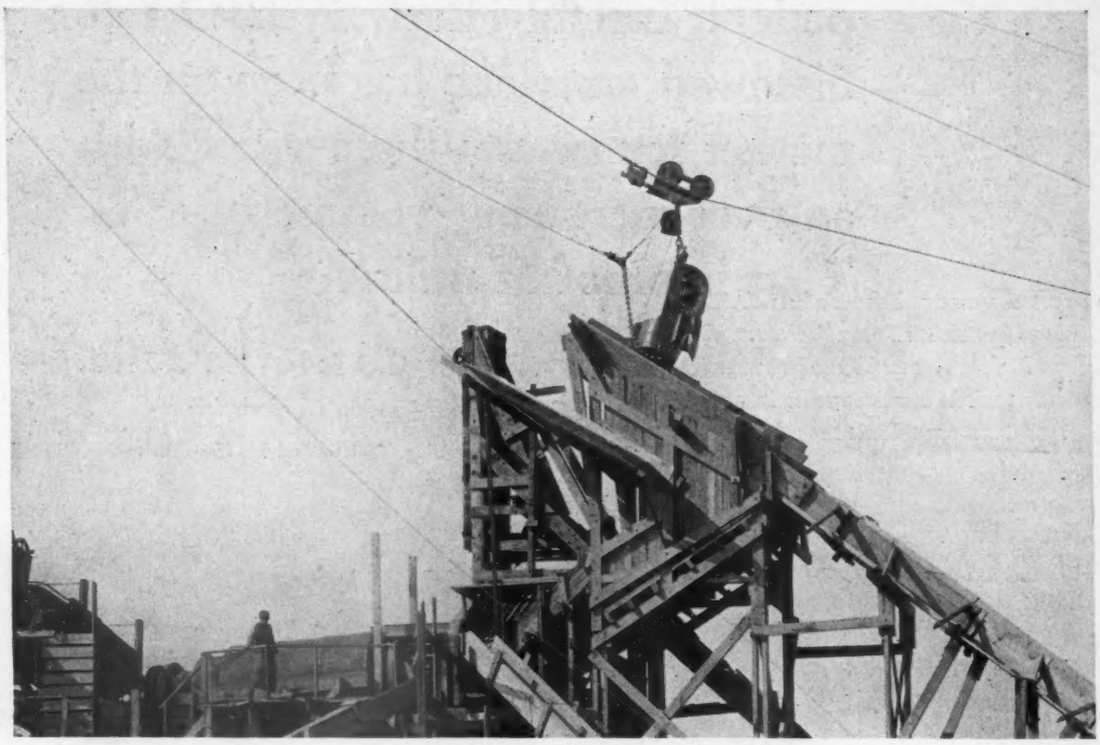
General Offices: Carbide and Carbon Bldg., 30 East 42d St., New York

31 Plants—102 Warehouses

Prest-O-Lite

DISSOLVED ACETYLENE

PAGE slackline cableways



CLEAN — FREE DUMPING — NO POWER REQUIRED

The Page Bucket dumps by gravity—no power is required. It is held over the grizzly by an automatic operating lock, and is dumped simply by releasing the load cable. The bucket can be dumped as fast or as slowly as the operator desires.

The Page Bucket digs in quickly and gets a full load of gravel. This quick filling together with the speed of dumping by gravity makes the entire slackline operation fast. A Page installation is simple and fool-proof, therefore it can be operated continuously. Complete cableway installations, or Page Buckets, steel masts, blocks, etc., will be furnished for any installation.

Write for Details

Page Engineering Co.

844 Rush Street **Chicago, Illinois**

Standard of the world PAGE

G.T.M. SPECIFIED GOODYEAR CONVEYOR BELT

FOR THE PIT RUN ROCK AND SAND CONVEYING SYSTEM IN THE CLAREMONT PLANT OF THE

UNION ROCK COMPANY

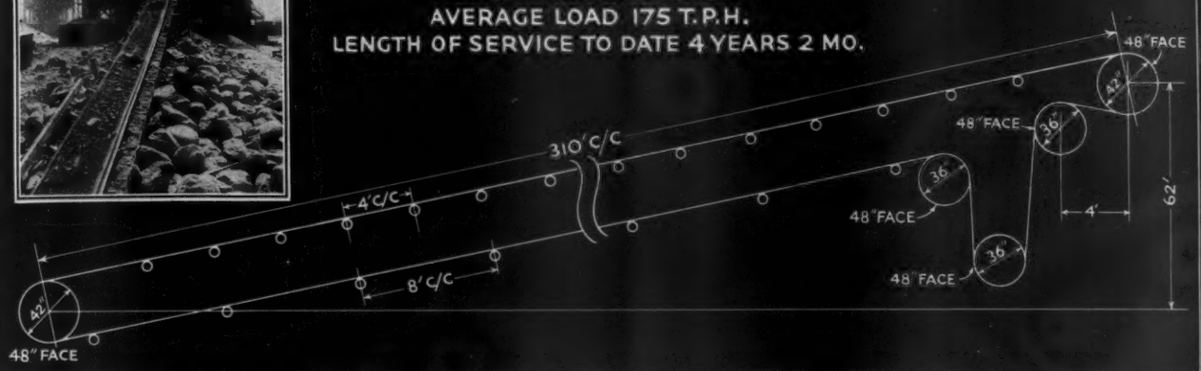
LOS ANGELES, CALIF.

OUTLINING THE 630'-42"-7 PLY BELT

BELT SPEED 250 F. P. M.

AVERAGE LOAD 175 T. P. H.

LENGTH OF SERVICE TO DATE 4 YEARS 2 MO.



Blueprint sketch of Goodyear-belted conveyor in Claremont plant of the Union Rock Company of Los Angeles, California; with inset photograph of conveyor in operation

Copyright 1923, by The Goodyear Tire & Rubber Co., Inc.

Bring on your rock—and the G. T. M.

All over the West, the Union Rock Company of Los Angeles, California, is known for the efficiency of its operation and the promptness of its service. Its methods of handling material are modern. Its equipment is up-to-the-minute. Everything about its 10 big plants, its 24 bunkers and its hundreds of delivery trucks, is such as to lead you to expect that here you would find Goodyear Belts and the G. T. M.—Goodyear Technical Man.

The G. T. M. is well-known in the plants of the Union Rock Company. His expert knowledge of rubber belting has been called upon repeatedly in the proper belting of elevators and conveyors. At one plant (that at Claremont, Calif.), he had the responsibility of co-operating with the Company's officials in determining the entire original belting installation for the plant. It was here, in 1923, that he specified the big Goodyear Conveyor Belt that is still on the job today.

His recommendation was made, as every G. T. M. recommendation must be made, only after a careful analysis of the duty required of the belt. He computed the dimensions involved, such as center-to-center distance, pulley diameters and faces, and the prospective load and speed. Along with the plant officials, he made an equally careful study of the plant operating conditions as they would affect the performance of the belt.

The Goodyear Conveyor Belt he recommended is 630 feet overall, 42-inch, 7-ply, Style C, with 3/16-inch top cover and 1/16-inch pulley cover. It was installed in December, 1923, and has borne its constant load of pit run rock and sand from the quarry to the screens, ten hours a day, 250 feet a minute, every working day since then.

Its record of performance has been the subject of repeated good report from the plant superintendent to officials of the Union Rock Company. It has given no trouble. It has stood up to its abrasive job with every evidence of lasting a long, long time. And it has been watched over in its operation by the G. T. M. with the same care for its con ervation that he took in its specification.

It stands to reason that belts so specified and built to their work should last longer, give more trouble-free service, and perform more efficiently and economically than belts that are bought haphazard—just so many feet of belting. And the records of G. T. M.-specified Goodyear Belts in conveying and transmission duty the world over bear out the logic of the Goodyear Analysis Plan—bear it out in better sustained operation at lower cost.

You may profit from getting acquainted with the G. T. M. He knows rubber, expertly, and he has a practical knowledge of conditions in many industries. You may rely on any Goodyear Mechanical Rubber Goods that he may recommend—Conveying and Transmission Belts, Hose, Valves and Packing—to give you the utmost in serviceability. To get in touch with the G. T. M., or for specific data on the records of Goodyear Mechanical Rubber Goods in your particular field, write to Goodyear, Akron, Ohio, or Los Angeles, California.

The Greatest Name in Rubber

BELTS • VALVES HOSE • PACKING

GOODYEAR

NOW comes the "CATERPILLAR" TWENTY TRACTOR

NEW!

NEW... and containing every feature of "Caterpillar" sure-footedness, dependability and sturdiness... backed by the now united experience of the two pioneer builders of track-type tractors, Holt and Best.

New, too, in design ... crisply up-to-date in its possession of the many refinements constantly being developed by the "Caterpillar" engineers.

And ready for new achievements in doing Better, Quicker, Cheaper work for road builders, farmers, loggers, contractors everywhere..for industries and for cities.

"Caterpillar" Tractors

2-TON • TWENTY • THIRTY
SIXTY

CATERPILLAR TRACTOR CO.

Executive Offices: San Leandro, California, U. S. A.
Sales Offices and Factories:
Peoria, Illinois San Leandro, California
Distributing Warehouse: Albany, N. Y.
New York Office: 50 Church Street
Successor to
BEST C. L. Best Tractor Co. The Holt Manufacturing Company HOLT

There is a "Caterpillar" Dealer near you.

CATERPILLAR
REG. U.S. PAT. OFF.

3528

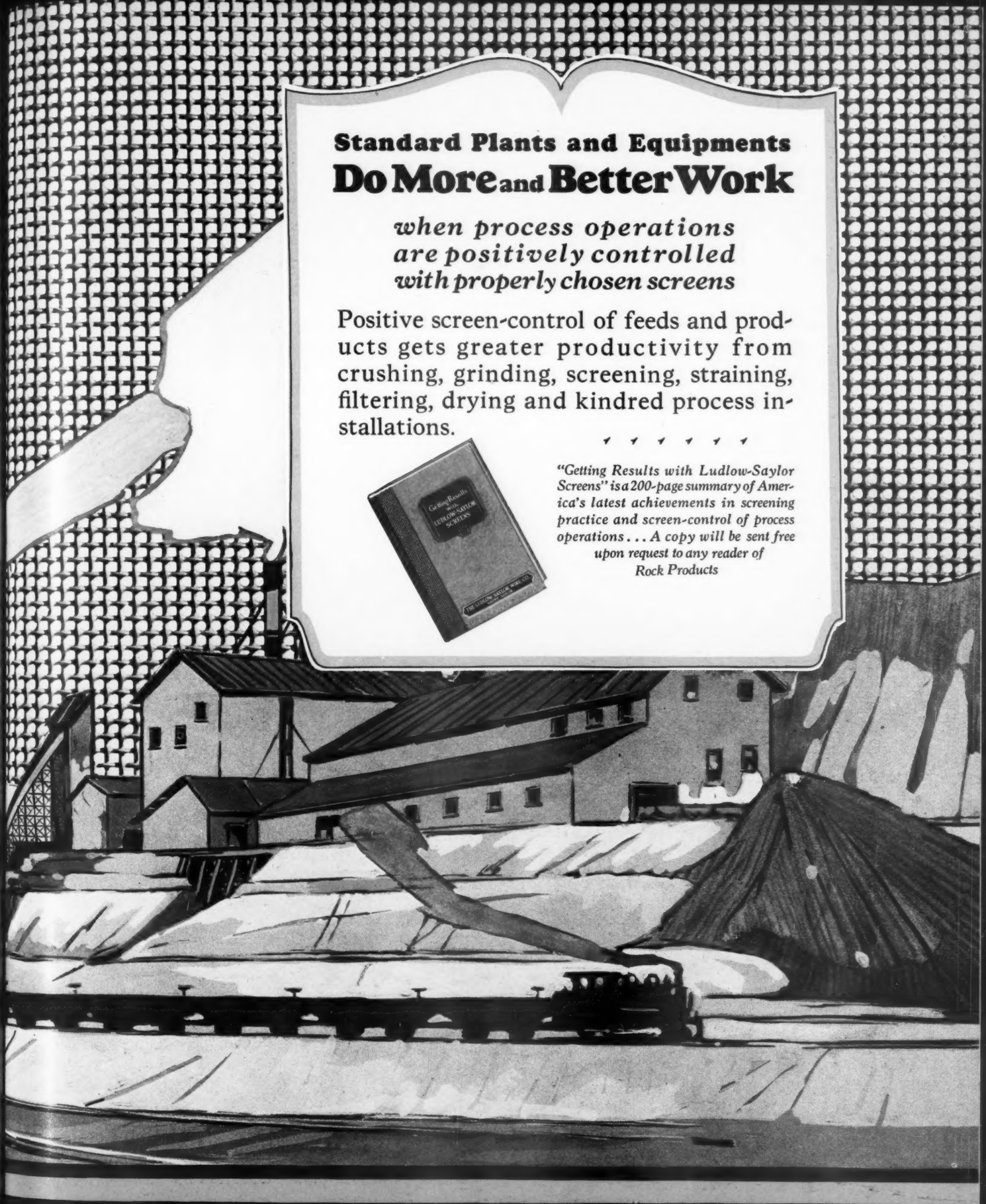
When writing advertisers, please mention ROCK PRODUCTS

Standard Plants and Equipments
Do More and Better Work

when process operations are positively controlled with properly chosen screens

Positive screen-control of feeds and products gets greater productivity from crushing, grinding, screening, straining, filtering, drying and kindred process installations.

"Getting Results with Ludlow-Saylor Screens" is a 200-page summary of America's latest achievements in screening practice and screen-control of process operations . . . A copy will be sent free upon request to any reader of Rock Products



The LUDLOW-SAYLOR
WIRE COMPANY
SAINT LOUIS
614 S. NEWSTEAD AVE.

LUDLOW-SAYLOR WIRE CO.
614 S. Newstead Ave.
St. Louis, Mo.
Please send us Book No. 48-G "Getting Results"

.....
.....
.....
.....

LUDLOW-SAYLOR WIRE CO.
614 S. Newstead Ave.
St. Louis, Mo.

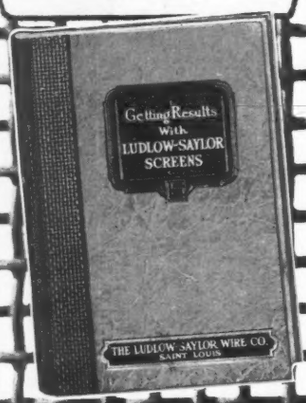
Please send us Book No. 48-G "Getting Results."

.....

.....

.....

.....



"Perfect" Results in the Screening Plant

reflect in every subsequent process.

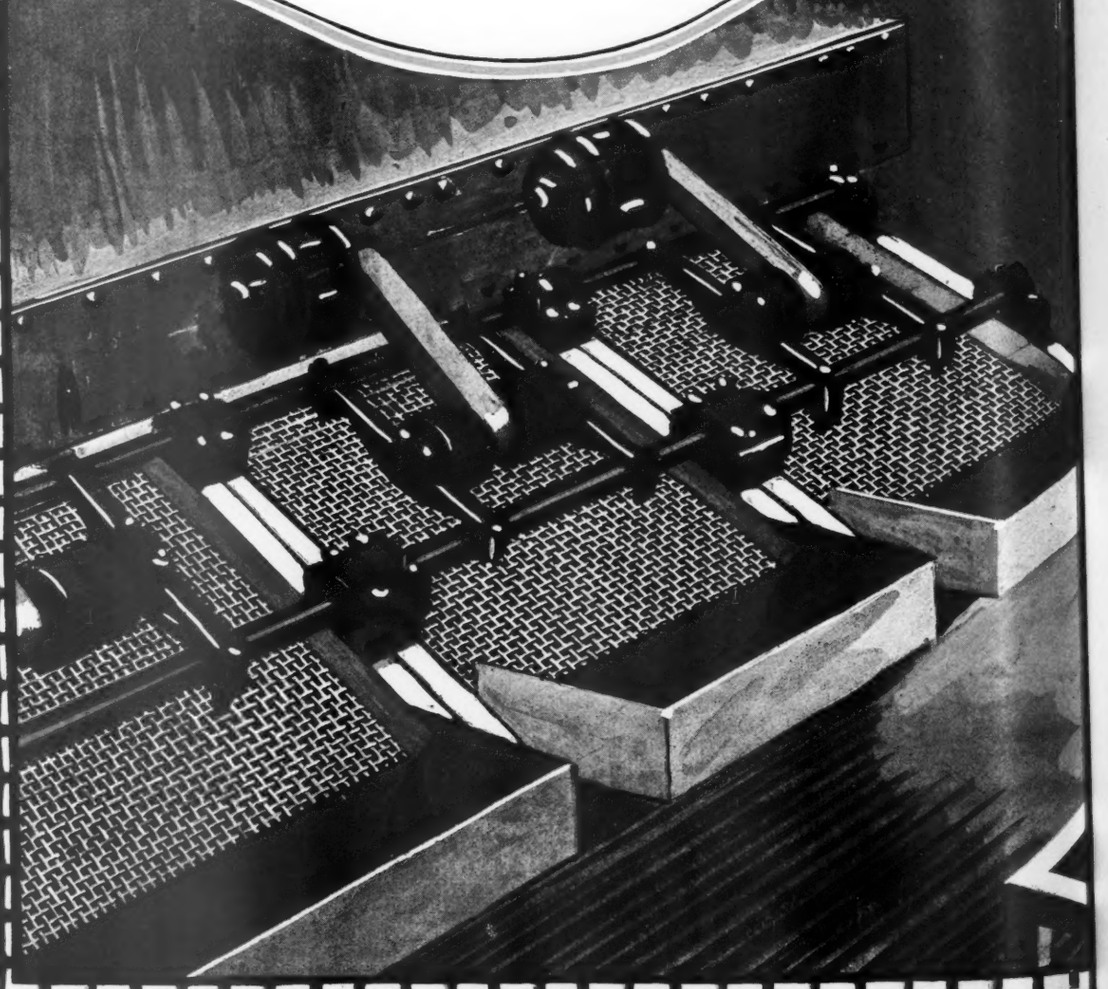
Feeds of uniform sizes, uniformly fed, are handled more quickly and more profitably in any process operation.

Take ball-mill grinding as the first example—feed too large for the largest balls must be reduced by WEAR, instead of breaking at the first blow of the heaviest ball.

Take sintering for the second example—recoveries are far larger, and losses much reduced, where feeds are properly screened and charged.

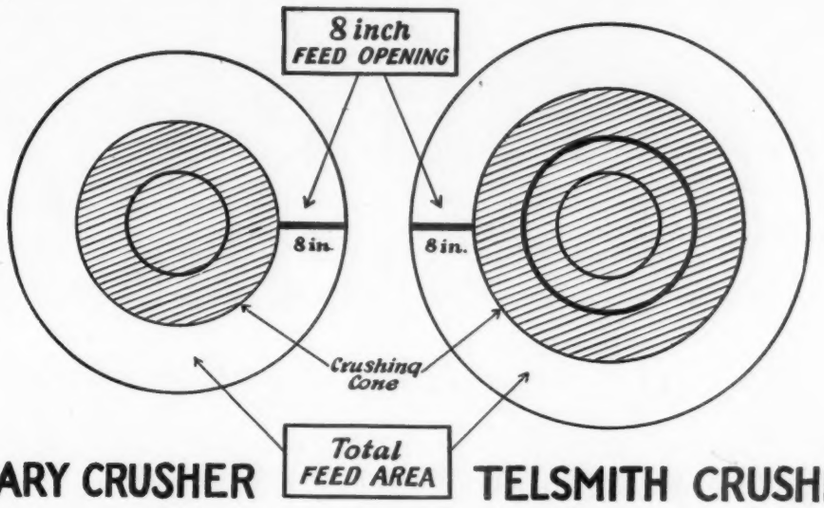
"Getting Results with Ludlow-Saylor Screens" is a 200-page summary of America's latest achievements in screening practice and screen-control of process operations.

A copy will be sent free upon request to any reader of Rock Products



The LUDLOW-SAYLOR WIRE COMPANY ST. LOUIS

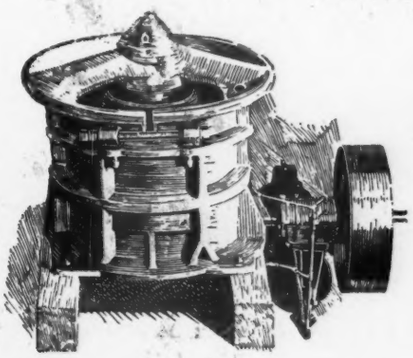
614 S. NEWSTEAD AVE.



Why *Telsmith has* Greater Feed Area

than other gyratory crushers

LOOKING at the diagram, you will see that the shaded inner circles represent the crushing cones in Telsmith and the ordinary gyratory crusher. The outer circles represent the rim of the crushing bowls—and the white portion between, the total feed areas. While the feed openings are the same width (8 in.) in each crusher, both crushing cone and bowl in a Telsmith are larger in diameter and the ***total feed area is greater.***



Here's the reason. Telsmith's eccentric is a long sleeve extending through the head and almost the entire length of the shaft. Since in Telsmith design the eccentric is placed ***between the shaft and the crushing cone***—Telsmith's crushing cone ***has to be made larger*** in diameter. It must enclose, not only the shaft itself, but the eccentric with its huge bearings.

Obviously, if Telsmith's crushing cone is larger in diameter, Telsmith's crushing bowl must be correspondingly larger to contain it. Since the area of any circle increases in proportion to the square of the diameter—Telsmith is bound to have a much greater feed area. This is only one reason for Telsmith's greater crushing capacity—let us give you further details. Write for Catalog 166 (Telsmith Primary Breaker) and Bulletin 2F11 (Telsmith Reduction Crusher).

SMITH ENGINEERING WORKS, 86 Capitol Drive, Milwaukee, Wis.

Canadian Representative: Canadian Ingersoll-Rand Co., Montreal, P. Q.

11 West 42nd St., New York City	Old Colony Bldg., Chicago, Ill.	80 Federal St., Boston, Mass.	Beckwith Mchy. Co., Pittsburgh, Pa.	Tower Mchy. Co., Cleveland, O.	Milburn Mchy. Co., Columbus, O.
Borchert-Ingersoll, Inc., St. Paul, Minn.	Knox Eq. & Eng. Co., Indianapolis, Ind.	Brandeis M. & S. Co., Louisville, Ky.	Bunting H. & M. Co., Kansas City, Mo.	Geo. F. Smith Co., St. Louis, Mo.	G. R. Mueller Co., Birmingham, Ala.

TELSMITH

P. B. 21

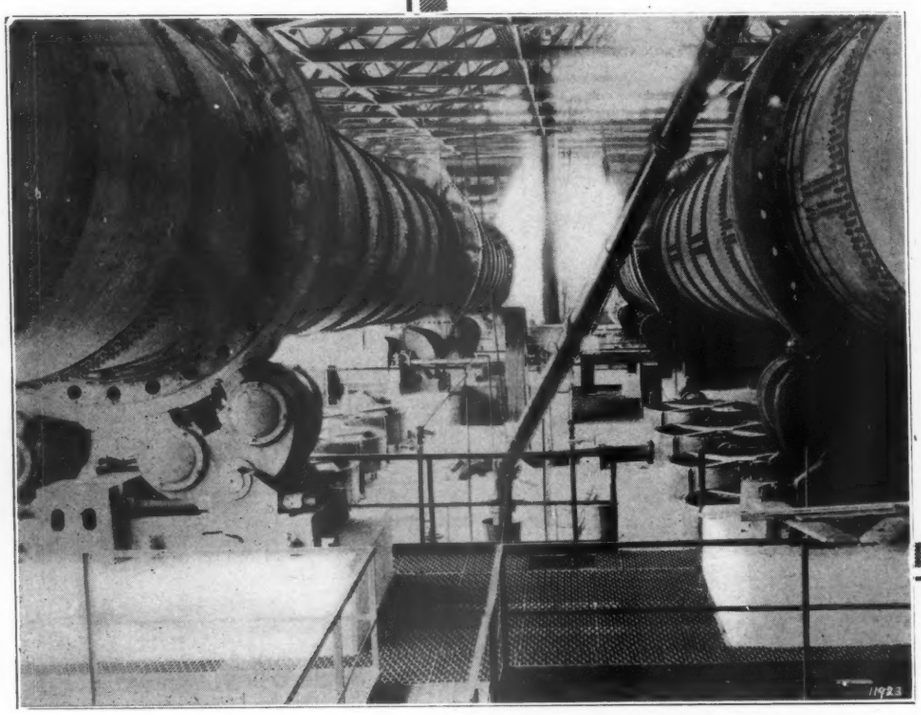
Positive Performance

Vulcan Products

Hoists,
Electric and Steam
Locomotives,
Steam, Gasoline, Electric
Rotary Kilns, Dryers, Coolers and Reasters
Fairchild Double-Discharge Ball Mill
Mine Ventilating Fans
Cages and Skips
Sheave Wheels
Corliss Engines
Coal Crushers
Gray Iron Castings
Open Hearth Steel Castings
Gears, Moulded and Cut Teeth
Special Machinery

SOME of the first rotary kilns to be used in this country for the production of Portland Cement were built by Vulcan. That, of course, was many years ago—and there have been many important developments in kiln design and construction since those pioneer kilns were built.

The cement industry, in its infancy, chose to depend on Vulcan engineering to build kilns. Today this same industry, now grown to one of gigantic proportions, still recognizes the unfailing dependability of Vulcan Equipment.



Hundreds of Vulcan Rotary Kilns are in use today throughout the world. Wherever cement is manufactured on a commercial scale, Vulcan Kilns are known and recognized for correctness of design, quality construction, and the consequent invariable satisfaction rendered.

A new Single Roller Bearing, self-lubricating and self-aligning, is now offered and provides further advantages of operation for Vulcan Kilns.

Write for Kiln Bulletin

VULCAN of WILKES-BARRE KILNS

VULCAN IRON WORKS
Wilkes-Barre, Pennsylvania

McCormick Bldg.
CHICAGO

50 Church Street
NEW YORK

When writing advertisers, please mention ROCK PRODUCTS

Cement Dust

ruins machinery! Diamond-like particles of cement dust, ground into motors, bearings and vital parts of machinery cause ***unnecessary*** maintenance and replacement costs.

makes working conditions bad! Excessive dust increases hazard, obscures vision and causes unnecessary and costly labor turnover.

greatly decreases profits! Every pound of cement dust that floats away has a cash value. Thousands of bags of dust are thrown away in this manner—dust that should be arrested, bagged and sold.

There is one way to turn those losses into profits. A Sly Dust Arrester will accomplish three very definite savings for you if your plant is dusty. 1. You will bag and sell dust that was formerly wasted. 2. Dust particles will be kept away from your machinery. 3. Working conditions will be greatly improved.

Write for Bulletin S-125

Cement Cooling

By a certain method recently developed, we are able to decrease the temperature of cement more than 100° F. after the final grinding. This eliminates burned bags, burned conveyor belts, facilitates loading and handling. Write to us for the facts covering this cement cooling process.

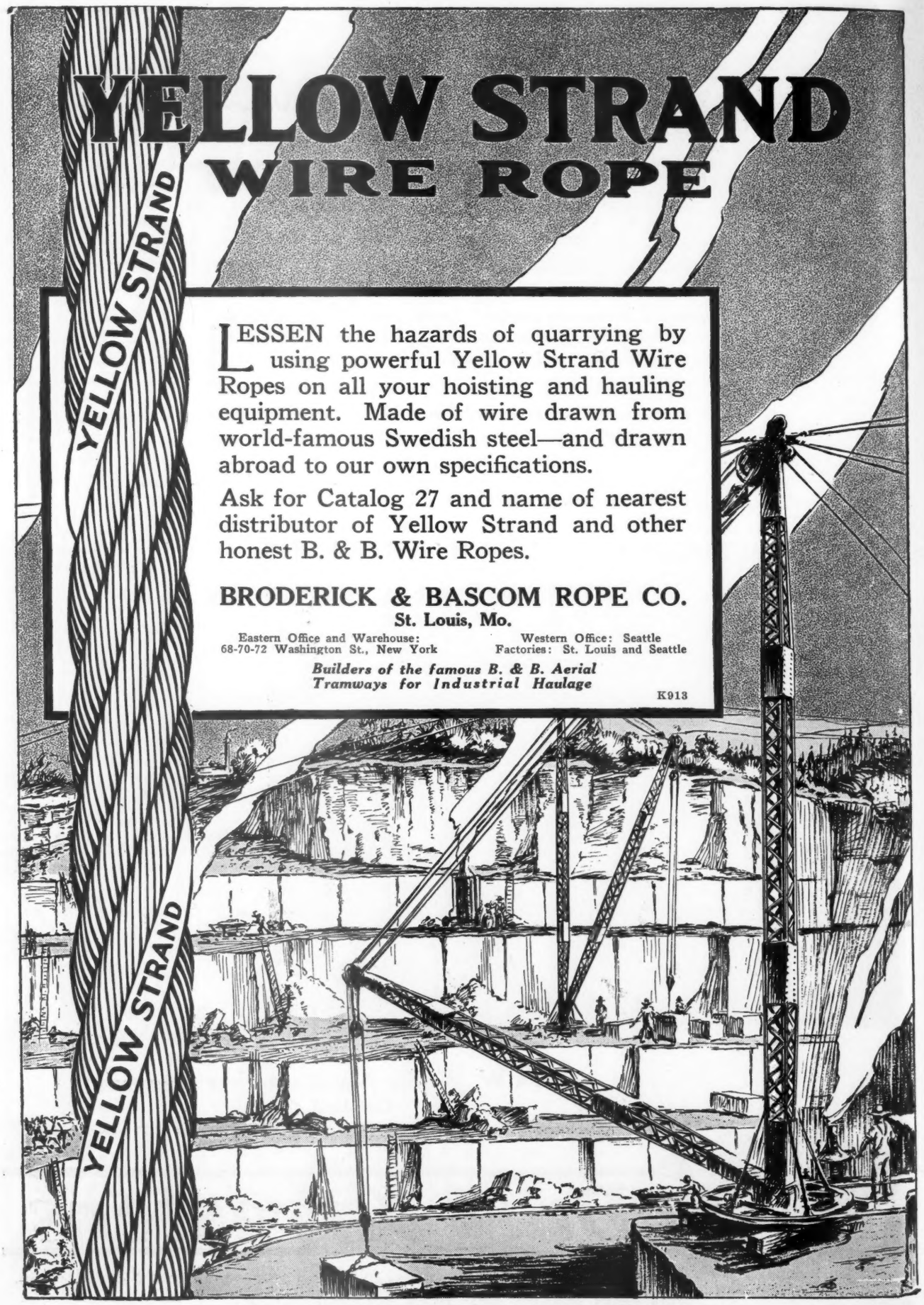
The W. W. Sly Manufacturing Company
Cleveland, Ohio

Established 1874 **Branches in Principal Cities**

SLY *Dust Arresters*

When writing advertisers, please mention ROCK PRODUCTS

YELLOW STRAND WIRE ROPE



LESSEN the hazards of quarrying by using powerful Yellow Strand Wire Ropes on all your hoisting and hauling equipment. Made of wire drawn from world-famous Swedish steel—and drawn abroad to our own specifications.

Ask for Catalog 27 and name of nearest distributor of Yellow Strand and other honest B. & B. Wire Ropes.

BRODERICK & BASCOM ROPE CO.
St. Louis, Mo.

Eastern Office and Warehouse: 68-70-72 Washington St., New York
Western Office: Seattle
Factories: St. Louis and Seattle

Builders of the famous B. & B. Aerial Tramways for Industrial Haulage

K913

HERCULES EXTRAS, No. 2 to No. 7

How to Cut Explosives Costs from 10% to 30%

HERE is a series of six explosives that is destined largely to displace the present Extra L. F. grades, the Specials, and in many instances the Gelatins. The new Extras are replacing the older types at savings in explosives cost that range from ten to thirty percent.

EXTRA No. 2 is nearest grade to	50%-60% Extra L. F. or 40% Gelatins
EXTRA No. 3 is nearest grade to	40%-50% Extra L. F. or 35% to 40% Gelatins
EXTRA No. 4 is nearest grade to	35%-40% Extra L. F. or 25% to 30% Gelatins
EXTRA No. 5 is nearest grade to	30% Extra L. F.
EXTRA No. 6 is nearest grade to	25% Extra L. F.
EXTRA No. 7 is nearest grade to	20% Extra L. F.

All of these new Hercules Extras have a weight strength of 70%.

However, the bulk strength (compared on a cartridge for cartridge basis) ranges from 20% for No. 7 to 50% for No. 2. And because of their higher cartridge count they cost less per cartridge than the grade which they replace.

The quality of the fumes produced by the new Hercules Extras makes them especially adapted for underground work. The accompanying table shows which one of the series to choose to replace the various strengths of Extra L. F. or Gelatins.

Write for further information giving details regarding the nature of your work and the explosive you are now using.

HERCULES POWDER COMPANY
(INCORPORATED)

Sales Offices:—Allentown, Pa., Birmingham, Buffalo, Chattanooga, Chicago, Denver, Duluth, Hazleton, Pa., Huntington, W. Va., Joplin, Mo., Los Angeles, Louisville, New York City, Norristown, Pa.. Pittsburg, Kan., Pittsburgh, Pottsville, Pa., St. Louis, Salt Lake City, San Francisco, Wilkes-Barre, Wilmington, Del.

Hercules Powder Company, Inc.
946 King Street, Wilmington, Delaware

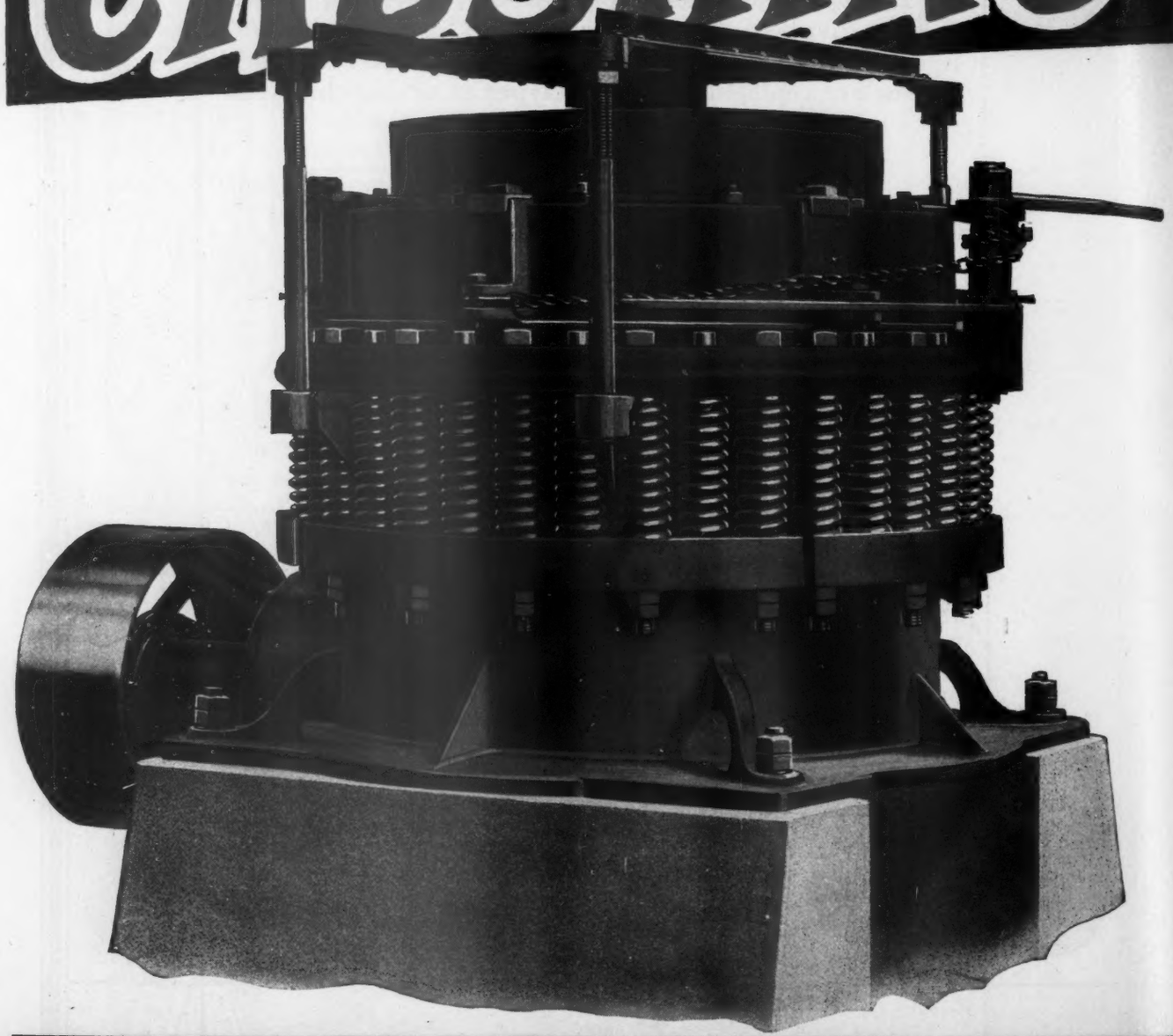
Please send me additional information regarding the new Hercules Extras, No. 2 to No. 7.

Name _____

Address _____

1513

increase your CRUSHING



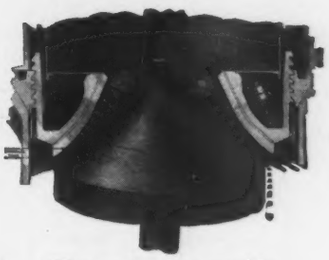
SYMONS

When writing advertisers, please mention ROCK PRODUCTS

CAPACITY

without extra equipment

Before the days of the "Cone" this meant more than simply crusher change-over—it meant additional space—extra equipment such as screens, conveyors, power units, etc.

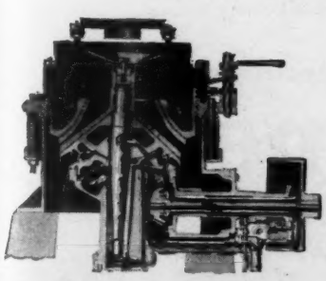


Illustrating the crushing action of the Cone

But—today—with the "Cone" *it actually means greater crushing output, crushed finer, with no more equipment and in many plants means cutting down the work required of auxiliary machinery.*

Just check these points—then write for descriptive catalog.

1.—a "Cone" requires no more space than an ordinary crusher—as a replacement it fits the same space. 2.—a "Cone" crushes to a uniform size—less circulating load—less oversize—less screening. 3.—a "Cone" requires less power. 4.—a "Cone" can be adjusted for different size products while crushing. 5.—in many cases one "Cone" is handling more material and crushing it finer than 2 to 3 previous crushers.



Sectional — showing Positive Oiling System

We'll be glad to tell you where Symons Cone Crushers are now making new capacity records.

SYMONS BROTHERS COMPANY

1462 STANLEY AVE, LOS ANGELES (HOLLYWOOD) CALIF.

111 W. WASHINGTON ST. CHICAGO, ILL.

51 EAST 42nd ST. NEW YORK, N. Y.

CONE CRUSHERS

TO MAKE good alloy steel requires good ferro-alloys. Electro Metallurgical Sales Corporation offers a complete line of ferro-alloys of high quality backed by more than 20 years of experience.

Our Service Department is maintained to demonstrate the proper use and benefits to be derived from these alloys.

. . .

CHROMIUM

High Carbon Ferrochrome (maximum 6% carbon)
Low Carbon Ferrochrome (in grades, maximum 0.10% to maximum 2.00% carbon)
Chromium Metal
Chromium-Copper
Miscellaneous Chromium Alloys

MANGANESE

Standard Ferromanganese 78 to 82%
Low Carbon Ferromanganese
Manganese Metal
Manganese-Silicon
Manganese-Copper
Miscellaneous Manganese Alloys

SILICON

Ferrosilicon 15%
Ferrosilicon 50%
Ferrosilicon 75%
Ferrosilicon 80 to 85%
Ferrosilicon 90 to 95%
Refined Silicon (minimum 97% silicon)
Calcium-Silicon
Silicon-Copper
Manganese-Silicon
Silico-Manganese
Miscellaneous Silicon Alloys

VANADIUM

All Grades

ZIRCONIUM

Silicon-Zirconium
Zirconium-Ferrosilicon

Are you meeting competition?

THERE are two ways to meet competition. One way is to reduce prices and to take lower profits; another way is to lower production costs.

The costs of repairs, maintenance and replacements are important items on your cost sheet. These costs may be greatly reduced by using special grades of alloy steel and iron for parts that are subject to wear, abrasion, corrosion and oxidation.

If you have mechanical equipment that is constantly breaking or wearing away and causing interruptions in continuous operation, you might be interested in finding a remedy for the trouble.

We suggest the following parts which may be made of alloy steel or iron and effect a saving.

Annealing furnace parts
Cement mill parts
Grate bars
Resistance grids
Resistance wire
Roofing material
Ball bearings, balls and races
Balls and linings for milling machinery
Crusher and stamp shoes
Dies, files, cutlery and drill steel
Gears, springs, wheels and tires
Rolls, chains, conveyors, sheaves
Ore feeders, shaker plates, refractory scraper plates
Rabble arms and blades
Skid bars, rails and troughs
Axle and rod forgings
Turbine blades
Valves, pipe and fittings
Pumps, liners and parts
Kettles, tanks and crucibles
Boiler fittings
Cams, couplings, pinions, reamers, sprockets, shear blades
Dredging equipment
Steam shovel dipper teeth
Bearings, blower parts, condensers, dryers
Extractors, fans, filters, ovens, pickling tubs, retorts, screens, sinks, stills, superheater tubs, vats, ventilators
Enameling trays, hardening trays and laboratory fittings

Electromet Brand *Ferro-Alloys and Metals*

Sole Distributors
ELECTRO METALLURGICAL SALES CORPORATION
Unit of Union Carbide and Carbon Corporation
Carbide and Carbon Building, 30 E. 42nd St., New York

IT is important, if operating costs count, to have maximum power where and when you need it. Thew Center Drive is designed to do this job. Crowd!—there is more power than you need. Hoist!—*all* the power jumps to this job. Swing!—*all* the power swings and returns the dipper at remarkable speed.

Fewer parts of full size rugged construction gives freedom from costly break downs. Center Drive power plus fewer delays means greater profits.

Center Drive is an important factor in excavating and material handling work—let us send you full details.

THE THEW SHOVEL COMPANY · *Lorain, Ohio*
Steam, Gasoline & Electric · Shovels · Cranes · Draglines

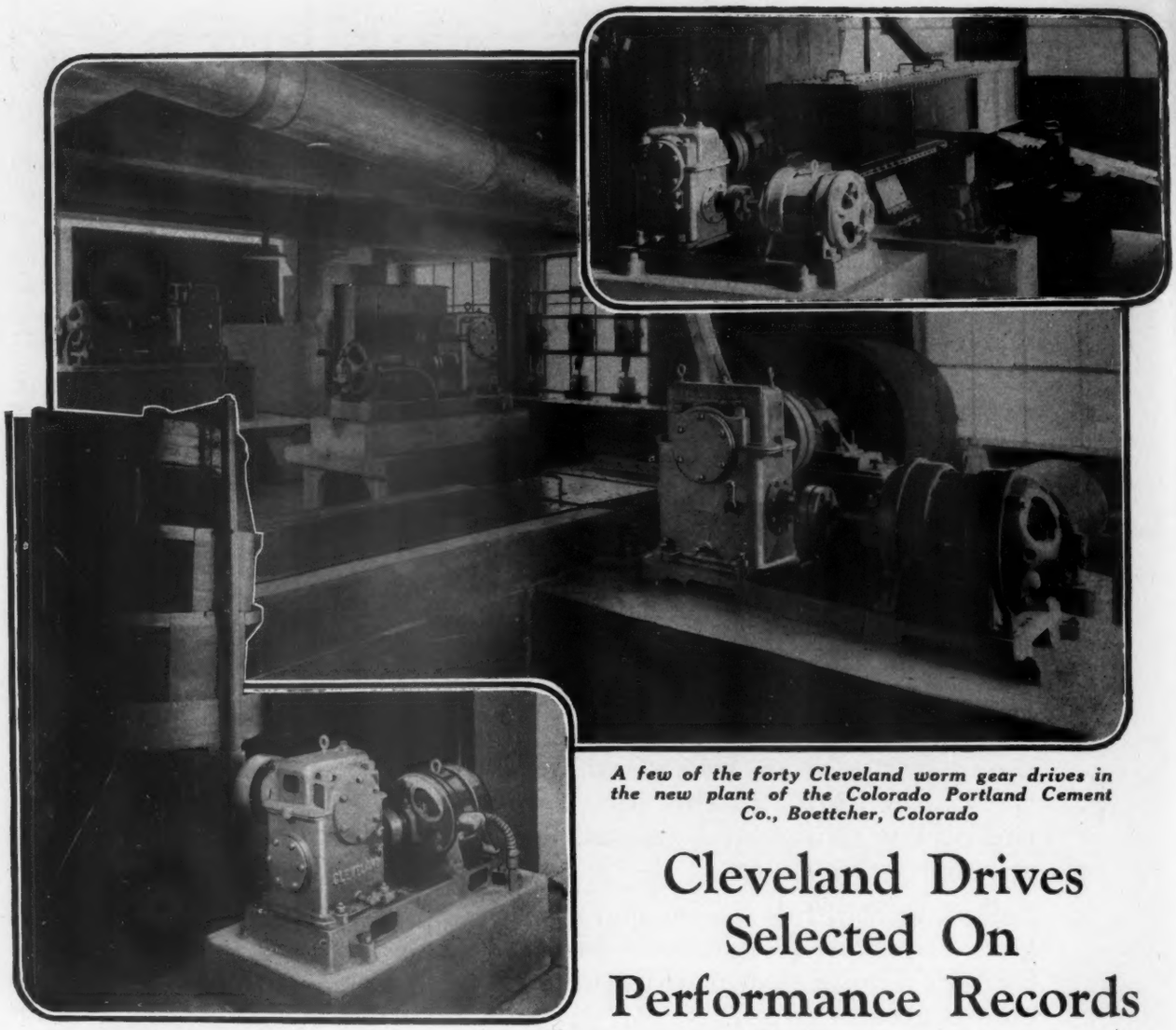
Thew Center Drive applied to swing, hoist and crowd gives the same rugged service that has made Thew Center Drive Trucks famous.

THEW

Gasoline or Electric Powered

LORAIN 60 AND 75

Shovels Cranes and Draglines



A few of the forty Cleveland worm gear drives in the new plant of the Colorado Portland Cement Co., Boettcher, Colorado

Cleveland Drives Selected On Performance Records

Cleveland TRADE MARK C W & G Co. WORM GEAR REDUCTION UNITS

For most power transmission problems throughout your plant the Cleveland worm gear reduction unit presents a very satisfactory solution. Send for a copy of Bulletin 106.

At its Portland, Colo., plant the Colorado Portland Cement Co. installed thirty-six Cleveland worm gear reduction units in 1924 and 1925. These units were used to drive screw and belt conveyors, bucket elevators, lineshafts, feeders, etc.

The above photographs, made in the new Colorado plant at Boettcher, show the excellent design and efficient arrangement. In this new plant, recently completed, there are forty Cleveland drives on all sorts of material-handling equipment, dryers, samplers and feeders.

In this and many other rock product companies the performance of the Cleveland worm gear units has led to additional installations. Actual economy, through low maintenance costs and elimination of production delays, features the Cleveland drive.

"Cleveland Worm Gearing—the Ultimate Drive"

CLEVELAND WORM & GEAR COMPANY

3272 EAST 80th STREET CLEVELAND, OHIO

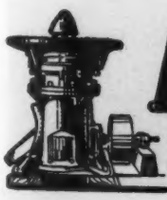
HARD LABOR

—crushing rock—tough work for men and machines—easy for the ruggedly capable Austin Gyratory Crushers—they are built for hard work on hard rock.

A Life Sentence

Correctly designed from years of experience and research—properly constructed with oversized eccentrics and eccentric bearings—special high-grade machined steel shafts—fully enclosed gears—automatic lubrication—all parts easily accessible—and intelligent consideration of your crusher needs.

See Austins wade into hard rock—learn about Austin Super-Crushing Power from any Austin user—bring your crushing problems to Austin.



AUSTIN MANUFACTURING CO.

ESTABLISHED 1858

400 N. MICHIGAN AVE. CHICAGO

When writing advertisers, please mention ROCK PRODUCTS

The heart *of any* Crushing Plant

We illustrate our Type K. F. 14x38 Roller-bear but we have many letters from users of our 9x38 and 9x28 models who insist the Roller-bear crusher is as good as money can buy---send for catalog.

Roller-bear TRADE MARK **Rock Crusher**

ALLOY STEEL AND METALS COMPANY
OF CALIFORNIA INC.

55th and Alameda St. Box 840 Arcade Station
LOS ANGELES CALIFORNIA

With a P&H, capacity means more than the size of bucket attached to the dipper sticks.....

A P&H 700 of 1¼ Cu. Yd. capacity is designed and engineered as a *1¼-yard machine*—with every part made to stand up under toughest going—with a 95 H. P. Motor to furnish all the power ever required.

P&H

MODEL 700

1¼ Cu. Yard Excavator

Weight 88,000 lbs.

95 H. P. Motor

Our new book "What is Capacity?" goes into this thoroughly and will give you a new slant on shovel buying. A card or note will bring it at once.

P&H

The P & H understanding of Capacity is "the ability to turn out big yardage over a long period of time at the lowest cost without excessive wear or depreciation."

It's the point of "excessive wear or depreciation" that many buyers overlook when dazzled by the low price on an over-rated machine. You cannot buy speed and alloy-steels cheap!

HARNISCHFEGER CORPORATION

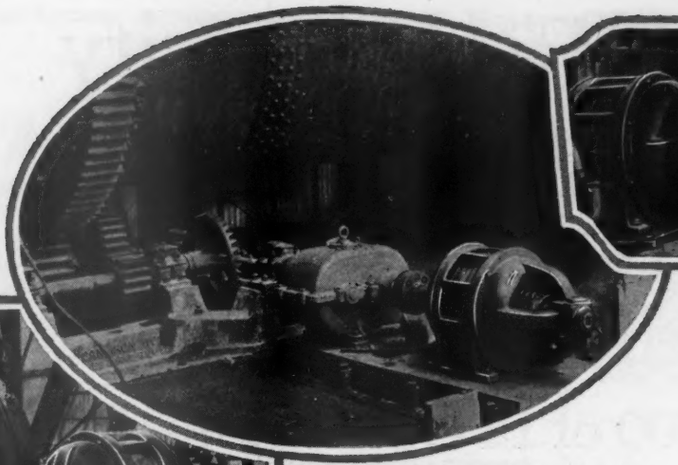
Established in 1884

3865 National Avenue, Milwaukee, Wis.

New York, Chicago, Charlotte, Pittsburgh, Los Angeles, Philadelphia, Kansas City, Detroit, Portland, Jacksonville, Birmingham, San Francisco, Dallas, Memphis, Seattle, Atlanta, Indianapolis, Baltimore, Boston, Minneapolis, St. Louis

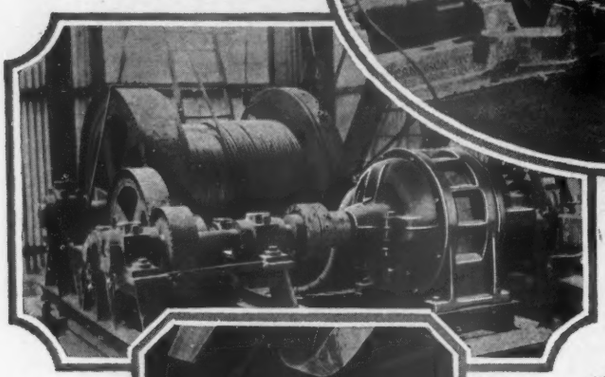
WAREHOUSES AND SERVICE STATIONS

Philadelphia, Memphis, Jacksonville, San Francisco, Los Angeles, Seattl.



100-hp., 440-volt, 875-r.p.m. G-E induction motor driving 42 by 48 rigid hammer crusher

50-hp., 440-volt, 696-r.p.m. G-E induction motor operating 3-speed reversible incline hoist



Vulcan dryer—6 by 45 feet—driven by 25-hp., 440-volt, 840-r.p.m. G-E slip-ring induction motor

20-hp., 440-volt G-E induction motor driving 4-valve Bates sacker

The plant of the National Gypsum Company is completely electrified by G.E.

Complete electrification by G. E.—crusher, pulverizers, kilns, elevators, conveyors, everything—that's a big reason why the National Gypsum Company, one of the world's largest, is a leader in the industry. Twenty-two units, with a combined horsepower of 500, drive the machines that produce this Michigan company's wall-board and mixed plaster.

In gypsum plants—as in many prominent cement plants—G-E Motorized Power is installed because of proved performance.

Your nearest G-E office will gladly supply information. G-E experts in gypsum plant applications are always ready to assist you.

Apply the proper G-E motor and the correct G-E controller to a specific task, following the recommendations of G-E specialists in electric drive, and you have G-E Motorized Power. Built in or otherwise connected to all types of industrial machines, G-E Motorized Power provides lasting assurance that you have purchased the best.

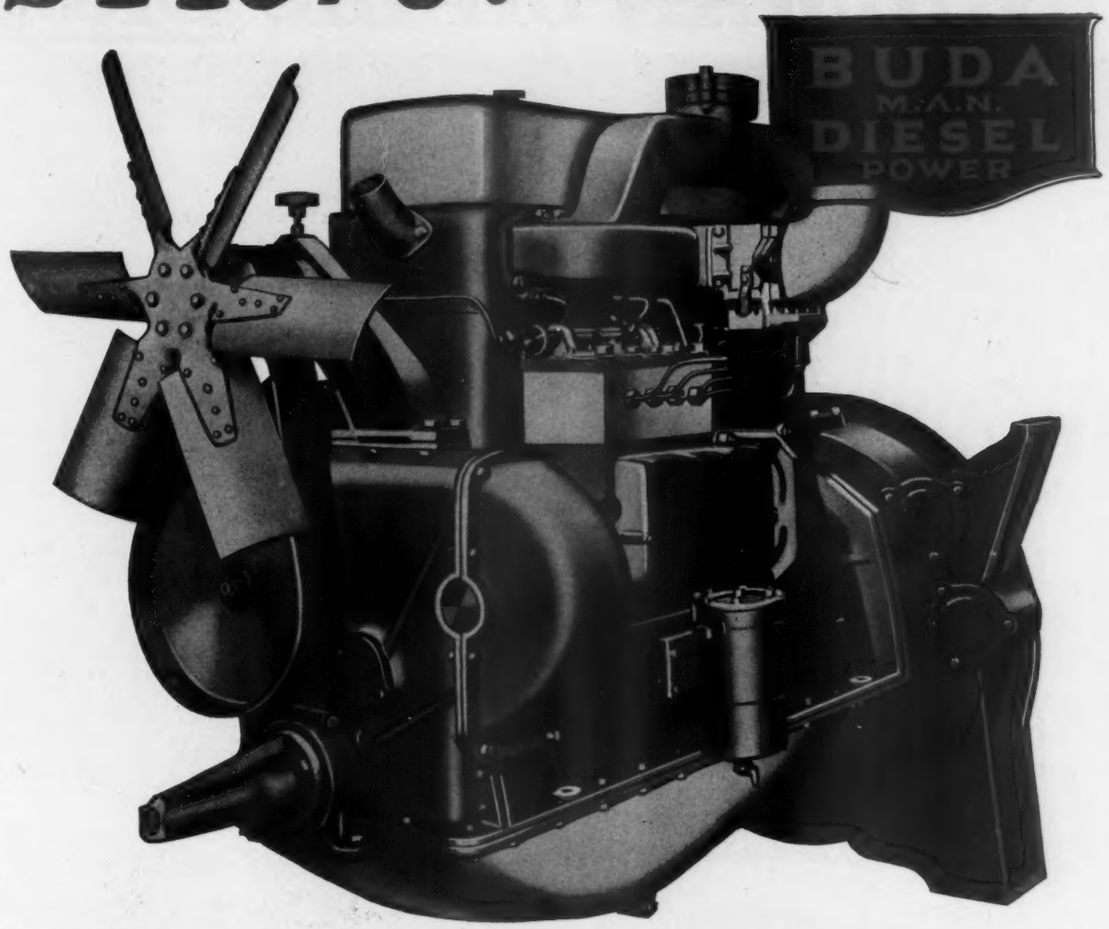
Motorized Power
—fitted to every need

200-143

GENERAL ELECTRIC

GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y., SALES OFFICES IN PRINCIPAL CITIES

It's Here! LIGHT WEIGHT HIGH SPEED



A FULL DIESEL *for Shovels, Cranes, Locomotives, Hoists, Electric Generators, Compressors, Etc., Etc.*

Now comes the greatest industrial power development in years . . . an engine that has all the advantages of the conventional heavy-duty type plus the fuel economy that is an inherent characteristic of the Diesel engine.

The Buda M. A. N. is a light-weight, high-speed, full-Diesel engine manufactured under license from the Maschinenfabrik Augsburg-Nurnberg A. G. of Germany, commonly known as the M. A. N. Company, in whose shops Dr. Rudolph C. Diesel built his first engine over 30 years ago. It is of the four-stroke-cycle type, and uses fuel having a Baume gravity of approximately 26 to 38. The 6x8 four-cylinder engine develops 92 brake horsepower at a normal speed of 1000 r.p.m.

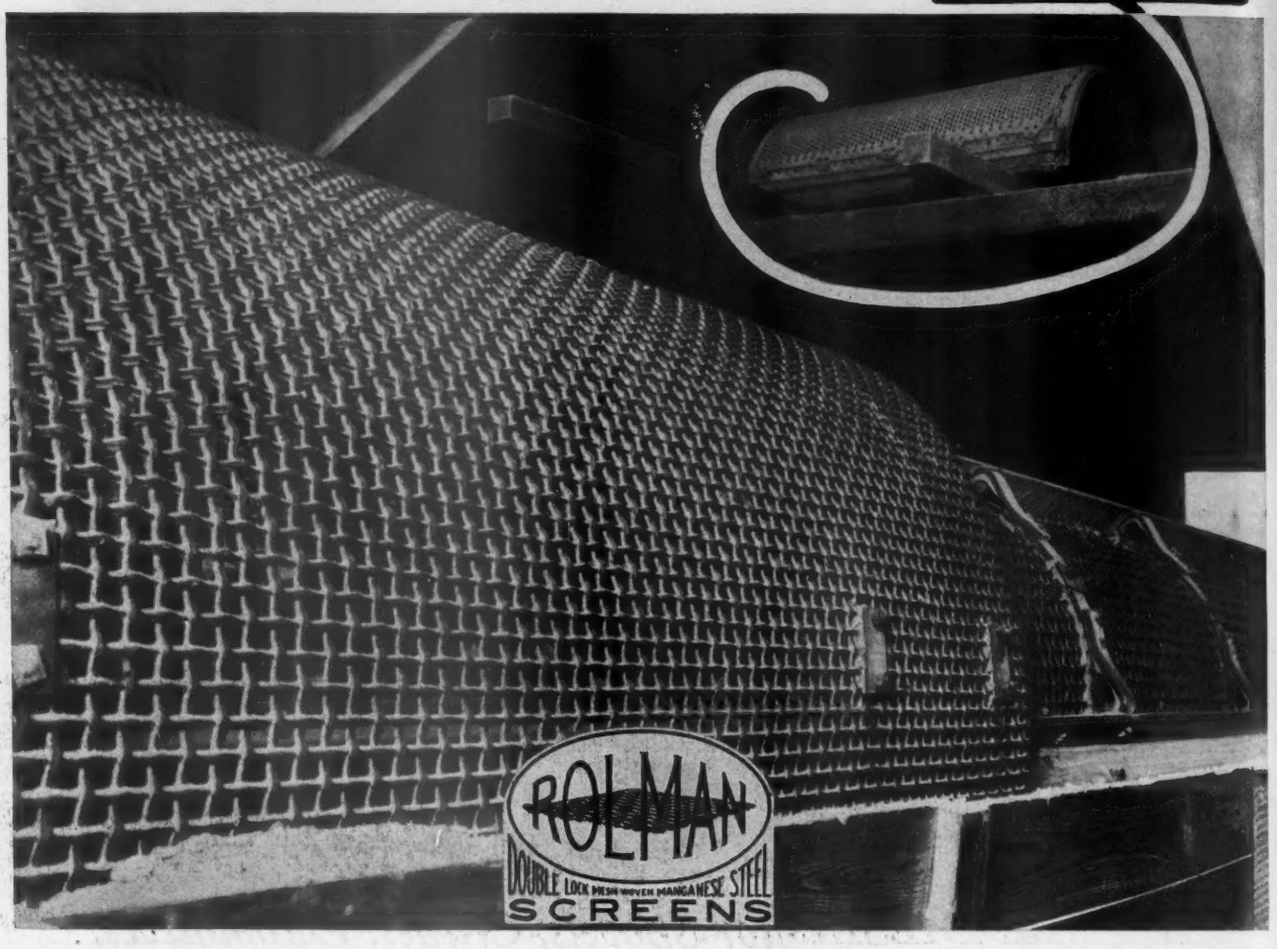
One of the main reasons for the lightness and compactness of this engine is the compressorless construction; that is, the system of injecting fuel into the cylinders without the aid of compressed air. The omission of an air compressor also contributes to the simplicity of operation. Other features include force-feed lubrication, self-starter, manual and governor speed regulation. Detailed information is given in Bulletin No. 633. Write for your copy.

THE BUDA COMPANY

HARVEY (*Chicago Suburb*) ILLINOIS

BUILDING AMERICA *with* BUDA POWER

You *Won't* find ROL-MAN on the Shelf



IF you would keep pace with the modern trend in plant equipment, visit the plants of the outstanding producers in the mineral aggregate industry. On every side you'll see antiquated materials and machinery being relegated to the scrap pile to make room for up-to-the-minute equipment that definitely increases plant efficiency and cuts production costs.

You won't find ROL-MAN on the shelf!

Built to meet the insistent demand for larger output of a more accurately sized, more salable product at the lowest possible operating cost, ROL-MAN Manganese Steel Screen Sections, as illustrated above, are replacing perforated plate and ordinary woven wire in screening plants throughout the country.

Why?—That's easy!

30% to 50% Greater Production. Cleaner, More Accurate Sizing. Many Times Longer Life.

Install Them Now

For complete information ask us to send you the booklet pictured above.

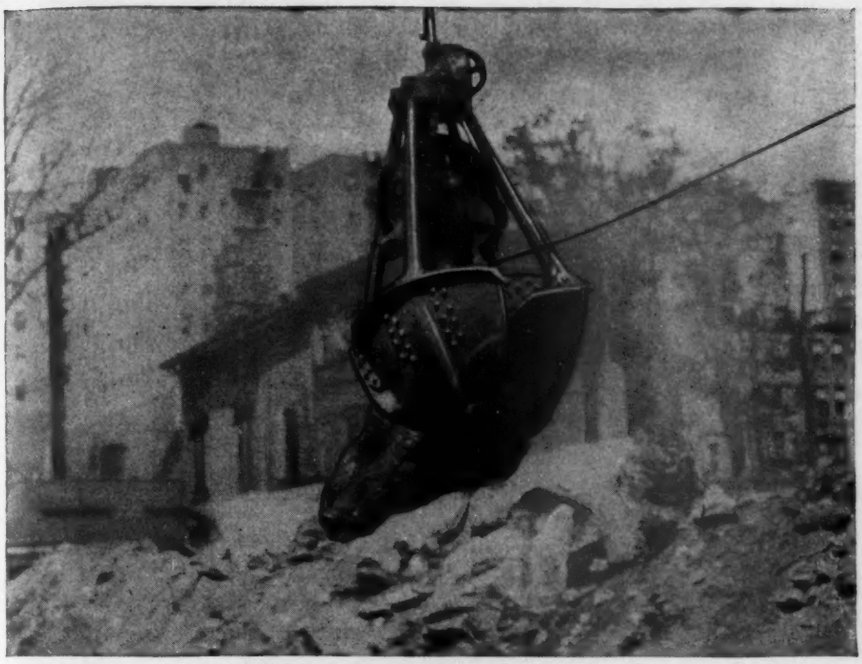
MANGANESE STEEL FORGE COMPANY

Richmond St. & Erie Ave., Philadelphia, Penna.

Manufacturers of ROL-MAN ROLLED MANGANESE STEEL PRODUCTS

NEW YORK 30 Church St. | PITTSBURGH Oliver Bldg. | DETROIT Lexington Bldg.

CHICAGO Old Colony Bldg. | LOS ANGELES 320 S. San Pedro St.



A regular part of the day's work

Rocks are a regular part of the day's work of Hayward Orange Peel Buckets. The sturdy jaws hold the big rocks as well as the little stones in a secure grip.

The Hayward Orange Peel Bucket, illustrated, excavated this fill, consisting of blasted rock and dirt.

Watch a Hayward Orange Peel in action. Note how the heavy blades grip the material. The design provides a leverage which insures sufficient closing power, and the sturdy construction has plenty of weight to withstand rough usage.

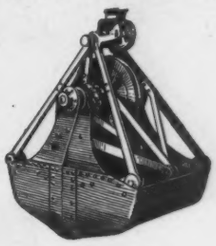
Send for bulletin 655, which describes and illustrates various types of Hayward Orange Peel Buckets.

THE HAYWARD COMPANY
200-204 Fulton Street New York, N. Y.

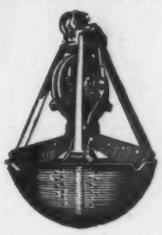
Builders of Clam Shell Drag Line, Orange Peel and Electric Motor Buckets; Dredging, Excavating, and Coal Handling Machinery; Automatic Take-Up Reels; Counterweight Drums.

Hayward Buckets

Electric Motor Buckets

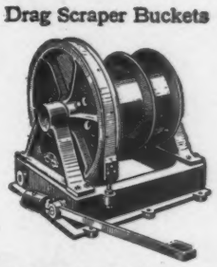


Clam Shell Buckets

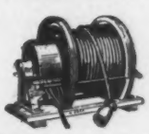


Orange Peel Buckets

Drag Scraper Buckets



Counterweight Drums



Automatic Take-Up Reels

Skid Excavators and Dredges

The Wonder *of* Air Separation

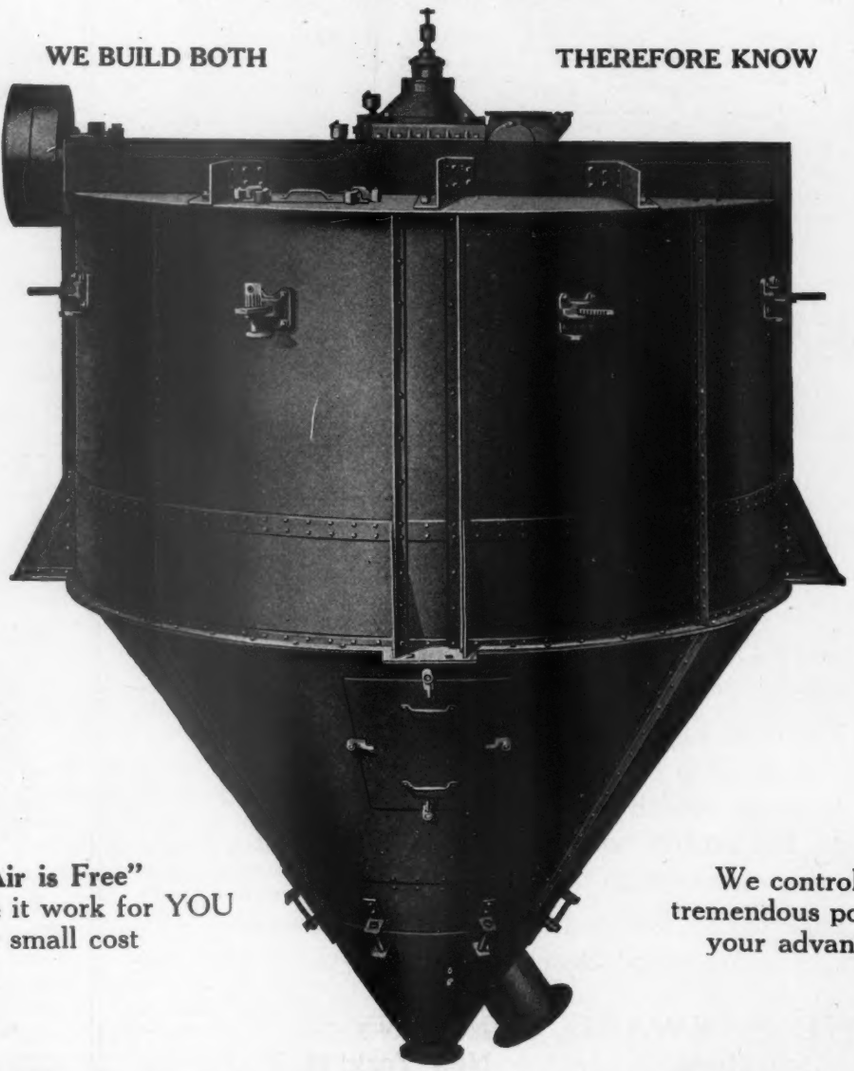
as compared with screens for fine separations

247 Million
cubical particles to the cubical inch
at **350** mesh
Air Separator Product

1½ Million
cubical particles to the cubical inch
at **60** mesh
Screen Product

Screens rapidly fall off in efficiency at meshes finer than 60.
Air Separator efficiency begins where screens fall off.

WE BUILD BOTH THEREFORE KNOW



"Air is Free"
We make it work for YOU
at small cost

We control its
tremendous power to
your advantage

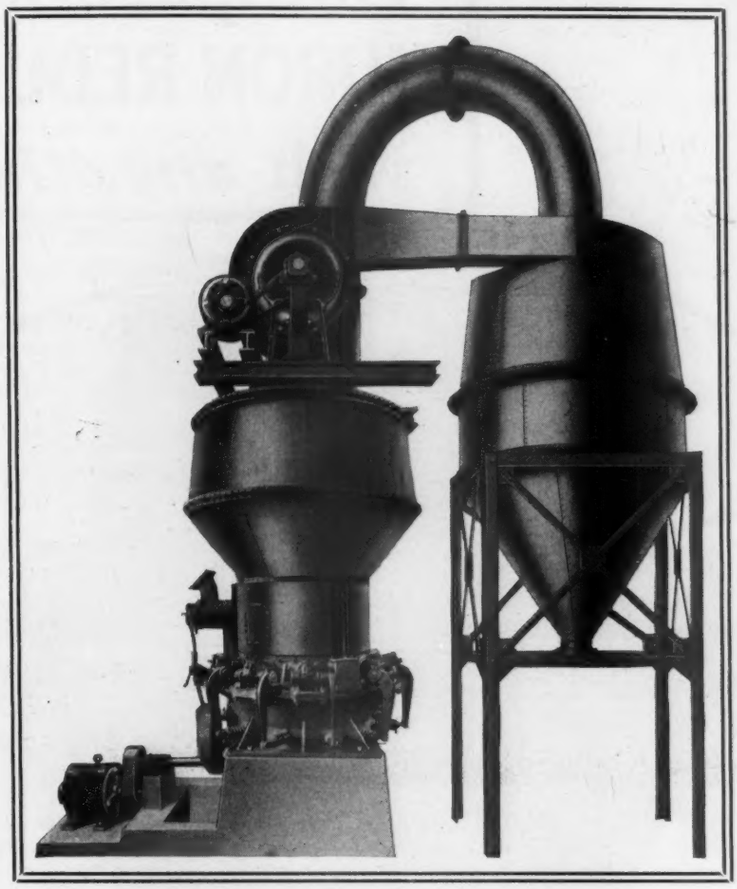
Air guarantees finenesses, evenness, and smoothness with almost no attendance or upkeep. This of course refers to

THE STURTEVANT WHIRLWIND CENTRIFUGAL SELECTORS

STURTEVANT MILL CO.

Harrison Square, Boston, Mass.

The Bethlehem Pulverizer



THE Bethlehem Pulverizer is demonstrating daily that it increases production and reduces power consumption and other operating costs.

A copy of Catalog J, describing the Bethlehem Pulverizer in detail, will be forwarded on request

BETHLEHEM STEEL COMPANY, ***General Offices:*** **BETHLEHEM, PA.**

District Offices:

New York, Boston, Philadelphia, Baltimore, Washington, Atlanta, Pittsburgh, Buffalo, Cleveland, Cincinnati, Detroit, Chicago, St. Louis, San Francisco, Los Angeles, Seattle, Portland

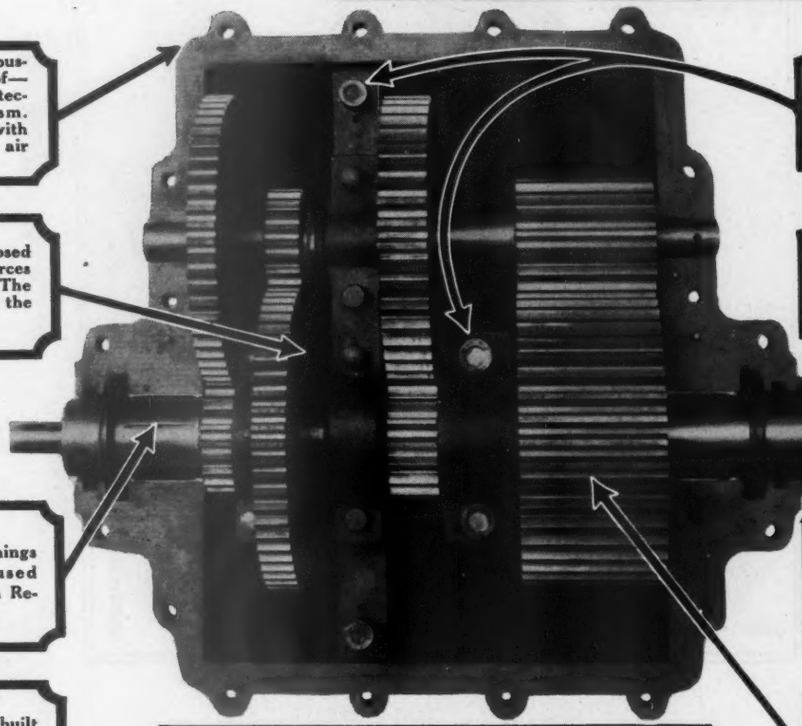
Bethlehem Steel Export Corporation, 25 Broadway, New York City, Sole Exporter of Our Commercial Products

BETHLEHEM

When writing advertisers, please mention ROCK PRODUCTS

Point for Point!

Compare the HURON REDUCER with *any other..*



The heavy semi-steel housing is oil and dust proof—insuring adequate protection to the mechanism. Housing is equipped with inspection cover and air vent.

A special pump inclosed within the housing forces oil to all bearings. The gears are lubricated by the splash system.

Phosphor bronze bushings and bearings are used throughout the Huron Reducer.

Huron Reducers are built for continuous 24 hour duty and are guaranteed to withstand 100% momentary overload.

All bearings, gears and shafting are rigidly upheld by supports cast integral with the housing.

All shafting is made up from special alloy steels accurately machined and designed for ample overload.

A thrust bearing on the drive shaft is optional equipment, and is recommended for direct drives with exceptional thrusts.

The stub tooth spur reduction gears are heat-treated and cut from high grade forgings of special alloy steel.

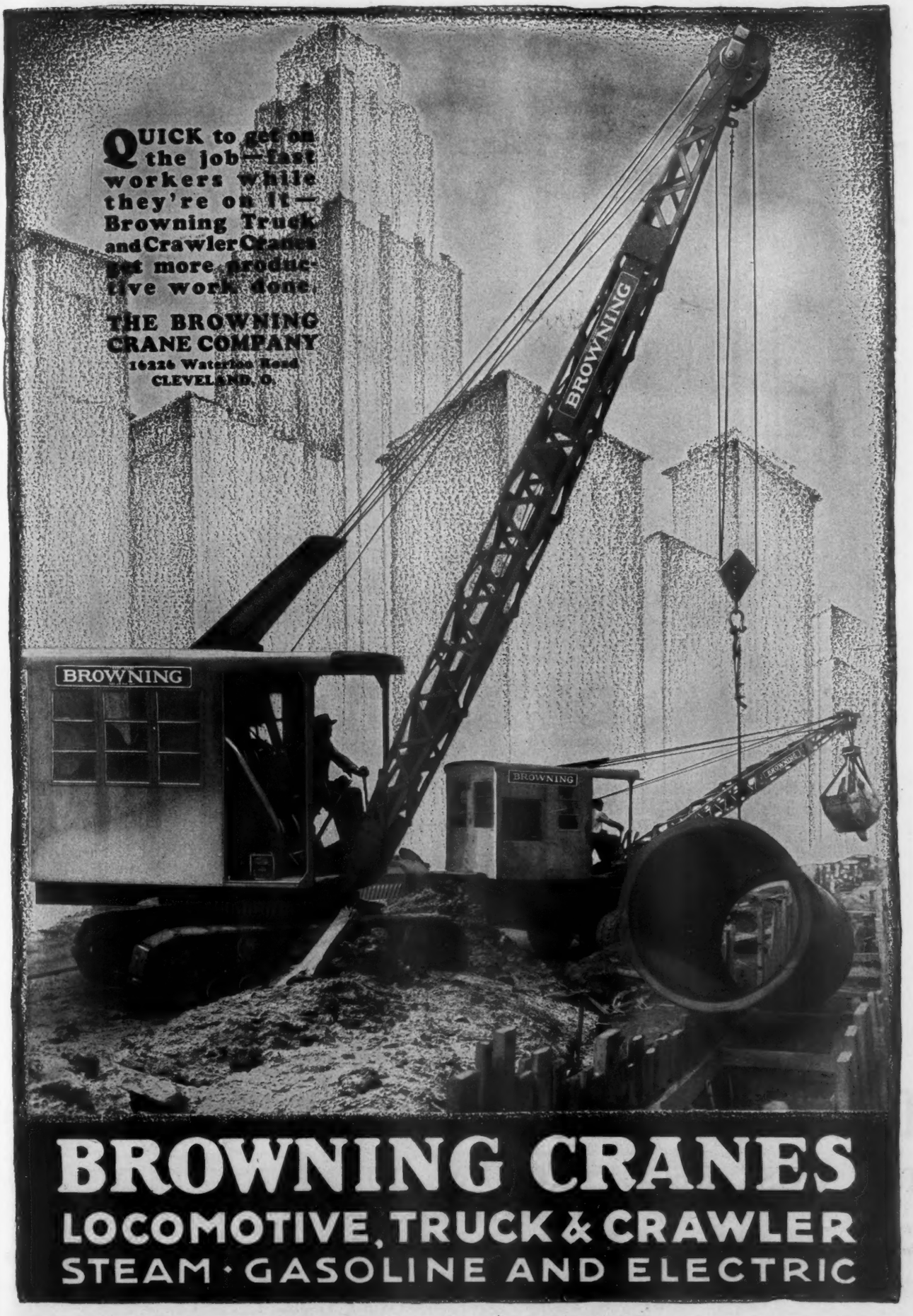
A new conception of accessibility is incorporated in the Huron Reducer. Nothing need be torn down or disassembled. By removing a few bolts the reducing mechanism is open for inspection or change of any part.

THE above points serve to illustrate the thoroughness of design and quality of construction incorporated in Huron Speed Reducers. These are the points of major importance that contribute to the superiority of Huron Reducers on every type of power drive. Complete catalog will be sent on request.

HURON INDUSTRIES INCORPORATED

Founders and Manufacturers

Alpena, Michigan


QUICK to get on the job—fast workers while they're on it—Browning Truck and Crawler Cranes get more productive work done.
THE BROWNING CRANE COMPANY
16226 Waterloo Road
CLEVELAND, O.
BROWNING
BROWNING
BROWNING
BROWNING CRANES
LOCOMOTIVE, TRUCK & CRAWLER
STEAM · GASOLINE AND ELECTRIC

DUSTLESS COAL DRYING!

and DRACCO does it..

THOUSANDS of barrels of the finest kind of valuable dust float off in the air each year—a total loss. In most instances, the dust cloud that is seen hovering in and around a cement mill, lime or gypsum plant is the most valuable part of the mill product compared volume for volume. Also, if costs would be ascertained, this dust costs more to produce than any other like volume which is saved.

Why do not all manufacturers prevent this enormous loss, turning this valuable material into profit?

There is a way to do it—the "DRACCO" Dust Collecting system. The above photograph is an example of how it is already being done in one of the most up-to-date cement plants in the country. The illustration shows a "DRACCO" Dust Collector installation for collecting coal dust from dryers, and indicates the dustless operating conditions prevailing in this plant. No loss of valuable dust here.

Equipment, men, neighbors — are protected from dust nuisance and the value of the collected dust pays for the installation. Profit due to improved conditions is clear.

We will gladly send you complete information

Dracco Dust Collecting System

THE DUST RECOVERING & CONVEYING COMPANY

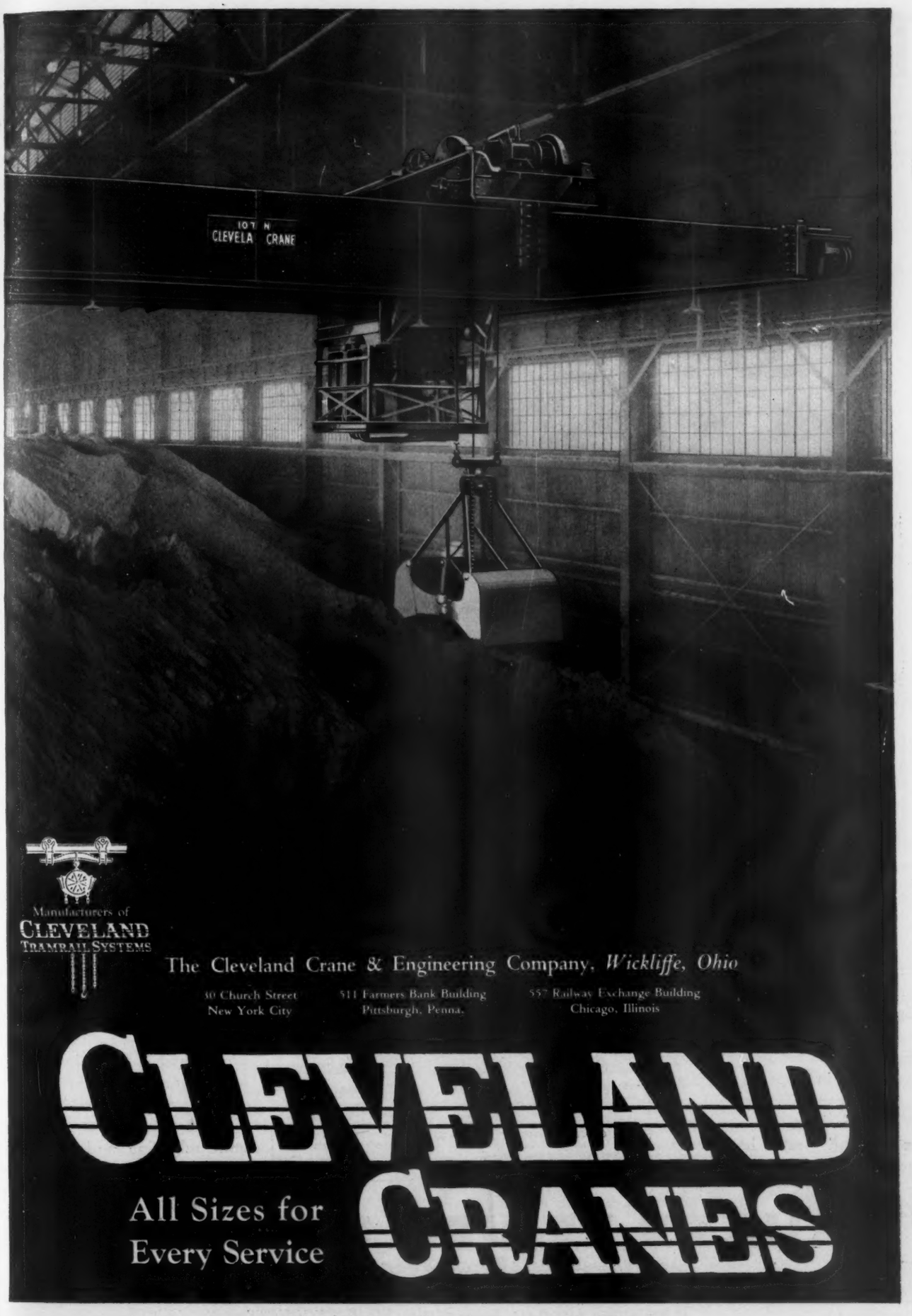
Engineers and Manufacturers

CLEVELAND, OHIO

Fume Recovery
Dust Collecting
Pneumatic
Conveying

Equipment
Engineering
Consultation

When writing advertisers, please mention ROCK PRODUCTS



Manufacturers of
CLEVELAND
TRAMRAIL SYSTEMS

The Cleveland Crane & Engineering Company, *Wickliffe, Ohio*

30 Church Street
New York City

511 Farmers Bank Building
Pittsburgh, Penna.

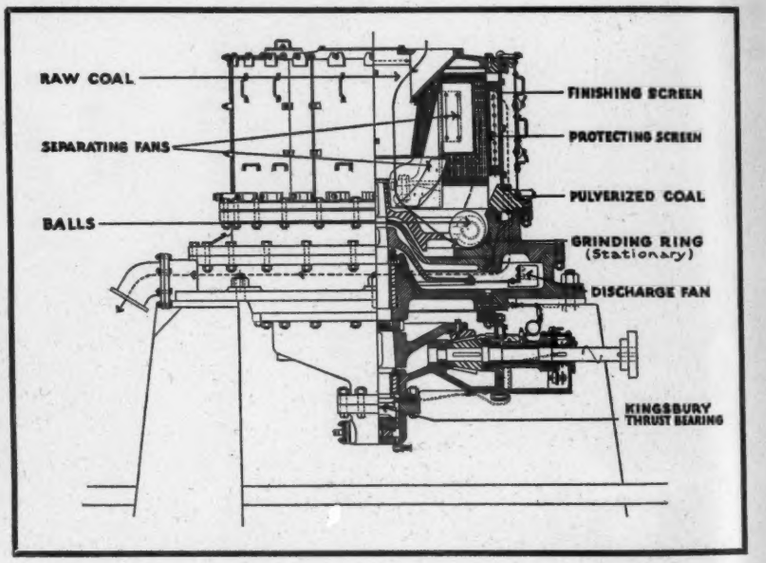
557 Railway Exchange Building
Chicago, Illinois

CLEVELAND CRANES

All Sizes for Every Service

Lehigh Pulverizing Mills

grind like the mortar and pestle of the chemist



An installation of Lehigh Pulverizing Mills in a large cement plant. To the right, a cut-a-way view of the Lehigh Mill, showing principle of operation

Fine grinding is absolutely essential in order that pulverized coal may be burned properly in a furnace. The degree of useful fineness is not completely determined by a screen test since best combustion efficiency requires a large proportion of very fine coal or impalpable powder.

As a means of obtaining impalpable fines, the chemist's mortar and pestle has never been surpassed. It is the same grinding principle that is responsible for the large amount of impalpable fines obtained with the Lehigh Pulverizing Mill. This type of mill grinds the coal by the centrifugal and gravity pressure exerted by four unattached balls rolling against a stationary, horizontal concave-shaped grinding ring. Wear has no effect upon the uniformly fine and constant pulverization obtained.

Fuller Lehigh Products for the Cement Industry

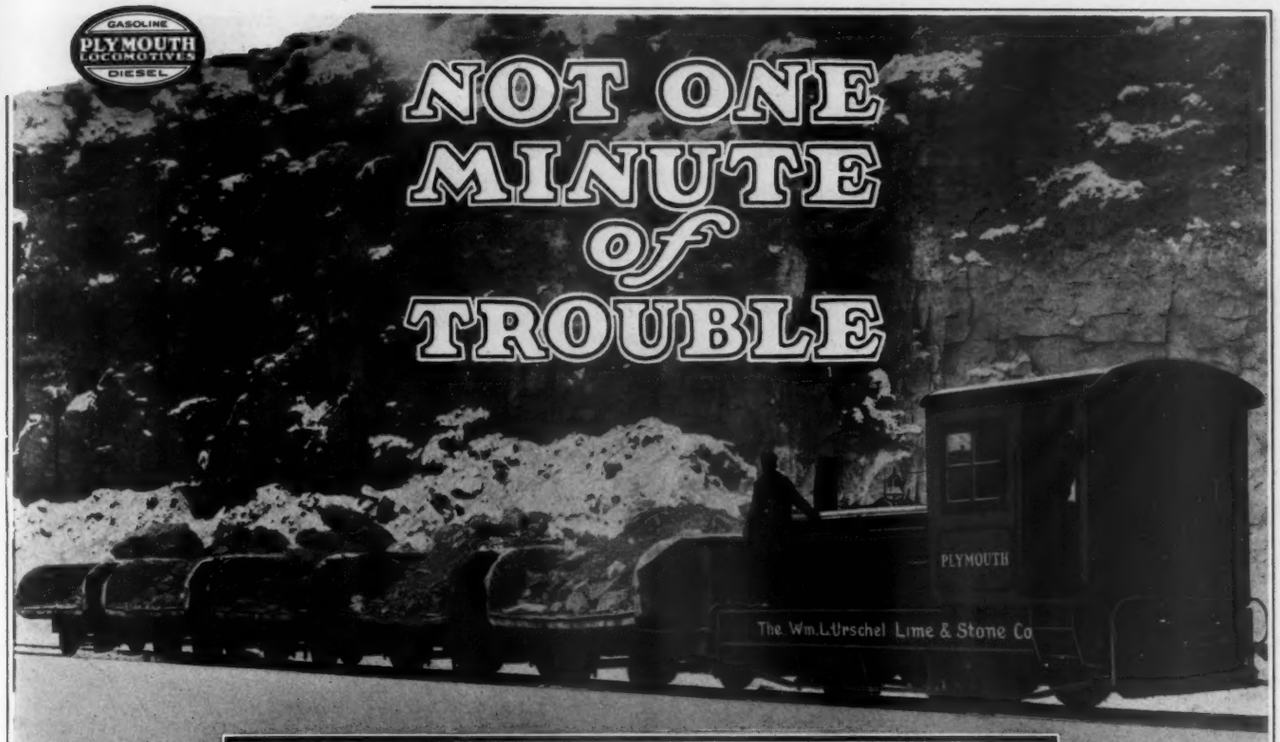
Complete Pulverized-Coal Equipment
Pulverizing Mills
Conveyor System for Pulverized Coal
Dryers—Rotary and Vertical
Feeders
Burners
Lining Plates for Tube Mills
Sprockets
Traction Wheels
Mill Balls and Parts
Roll Heads
Crusher Repairs

FULLER LEHIGH COMPANY

[A Babcock & Wilcox Organization]

FULLERTON----PENNSYLVANIA

When writing advertisers, please mention ROCK PRODUCTS



AND SERVING 10 HOURS DAILY SINCE SEPTEMBER 1926

at the quarry of The William L. Urschel Lime & Stone Co., Gibsonburg, Ohio.

Mr. W. H. Bruns, Jr., General Superintendent, makes this report on November 15, 1927: "The average haul for this 20-ton Plymouth Gasoline Locomotive is 600 feet, over a track having two very sharp curves and 4 per cent grade. Five cars loaded to 18 tons are kept going 10 hours per day on an average gasoline consumption of 20 gallons."

This company also operates an 8-ton Plymouth Gasoline Locomotive which they purchased in 1924.

Rock bottom economy is what is needed in the Rock Products Industry and PLYMOUTHS are built for just that purpose.

THE WILLIAM L. URSCHEL LIME & STONE CO.
GIBSONBURG, OHIO.
Nov. 15, 1927.

The Fate-Root-Heath Co.,
Plymouth, Ohio.

Gentlemen:

We are pleased to attach herewith the haulage data on our 20-ton Plymouth.

Our 20-ton job, purchased in September, 1926, has not given us one minute of trouble and has been going daily from time of installation.

We like your courteous treatment and appreciate the fact that you convinced us in the beginning that the Plymouth was a dependable product.

Very truly yours,
The William L. Urschel Lime & Stone Co.
W. H. Bruns Jr.
Superintendent.

If it's a Track Haulage Problem There's a PLYMOUTH to Solve it

THE PLYMOUTH LINE OF GASOLINE AND DIESEL LOCOMOTIVES IS COMPLETE FROM TWO TO FIFTY TON SIZES.

PLYMOUTH LOCOMOTIVE WORKS
The Fate-Root-Heath Company
PLYMOUTH, OHIO

THE PLYMOUTH 50-TON DIESEL

PLYMOUTH

GASOLINE *Locomotives* DIESEL

KOEHRING

Makes Money at the Stock Pile!

SPEED pays a profit at the stock pile, as it does anywhere!

There's eager speed to the Koehring—a zestful willingness that answers the control levers with high-speed functioning and precision that melt work away like a spring thaw!

Speed begins at the control levers—in the Finger Tip ease of control giving the operator that sensitive "feel" of the load which insures his confidence and gives him high-speed accuracy.

In every function the Koehring is FAST! Fast in hoisting — fast swinging!

It's not merely "tuned up" but it's *built* for speed in every fundamental of design and construction!

That's why the Koehring gives you speed with no penalty of excess wear or depreciation!

Know the Koehring — its speed — its Heavy Duty Construction.

Crane Capacities

Based on 66⅔% of Overturning Load

Quickly convertible to shovel or dragline.

No. 301—10 Tons at 12' Radius; 1 Yd. Clamshell Bucket at 28' Radius, 40' Boom; ¾ Yd. Clamshell Bucket at 34' Radius, 45' Boom; ½ Yd. Clamshell Bucket at 41' Radius, 50' Boom.

Wisconsin four cylinder gasoline engine, 5¼" x 6½", 1,000 R. P. M.

No. 501—17 Tons at 12' Radius; 1½ Yd. Clamshell Bucket at 31' Radius, 45' Boom; 1¼ Yd. Clamshell Bucket at 36' Radius, 45' Boom; 1 Yd. Clamshell Bucket at 41' Radius, 50' Boom; ¾ Yd. Clamshell Bucket at 48' Radius, 55' Boom.

Wisconsin four cylinder gasoline engine, 6"x7", 925 R.P.M.

Write for Bulletin No. C. R. 29

KOEHRING COMPANY MILWAUKEE, WISCONSIN

PAVERS, MIXERS—GASOLINE SHOVELS, CRANES AND DRAGLINES

Sales Offices and Service Warehouses in all principal cities

Foreign Department, Room 1370, 50 Church Street, New York City

Mexico, F. S. Lapum, Cinco De Mayo 21, Mexico, D. F.

A-4514-I

KOEHRING K HEAVY DUTY

New in Design - - - *Fast!*

New in Performance *Economical!*

DOBBIE FULL ROTATING DERRICK

TRADE MARK DOBBIE ESTABLISHED 1862

Working on the foundations of the 42 story Union Trust Co. building in Detroit, Mich., two Dobbie Full Rotating Derricks did the work of five or six of the ordinary stiff-leg type.

THE new Dobbie FULL ROTATING Derrick is a development that marks a revolutionary advance in design and efficiency of derrick equipment. For a multitude of jobs on which derricks can effectively be used, this *"full swing"* derrick has a tremendous advantage over the ordinary stiff-leg derrick with its 3/4 swing —since the full rotating feature increases the working area by 75 per cent.

This new derrick revolves on a single circular track—on roller bearing equipped wheels. It is unusually fast—capable of making 2.4 revolutions per minute. Construction is of steel throughout and operation is by a Mundy 3-speed Hoist powered by a 60 hp. engine.

Write for full details regarding this new development.

TO EQUIPMENT DISTRIBUTORS

Some Exclusive Sales Territories are now Available.

A Complete Stock of

Hand Winches
Sheaves
Blocks
Wood Derrick Fittings

are carried in stock at

74 WARREN STREET
NEW YORK CITY

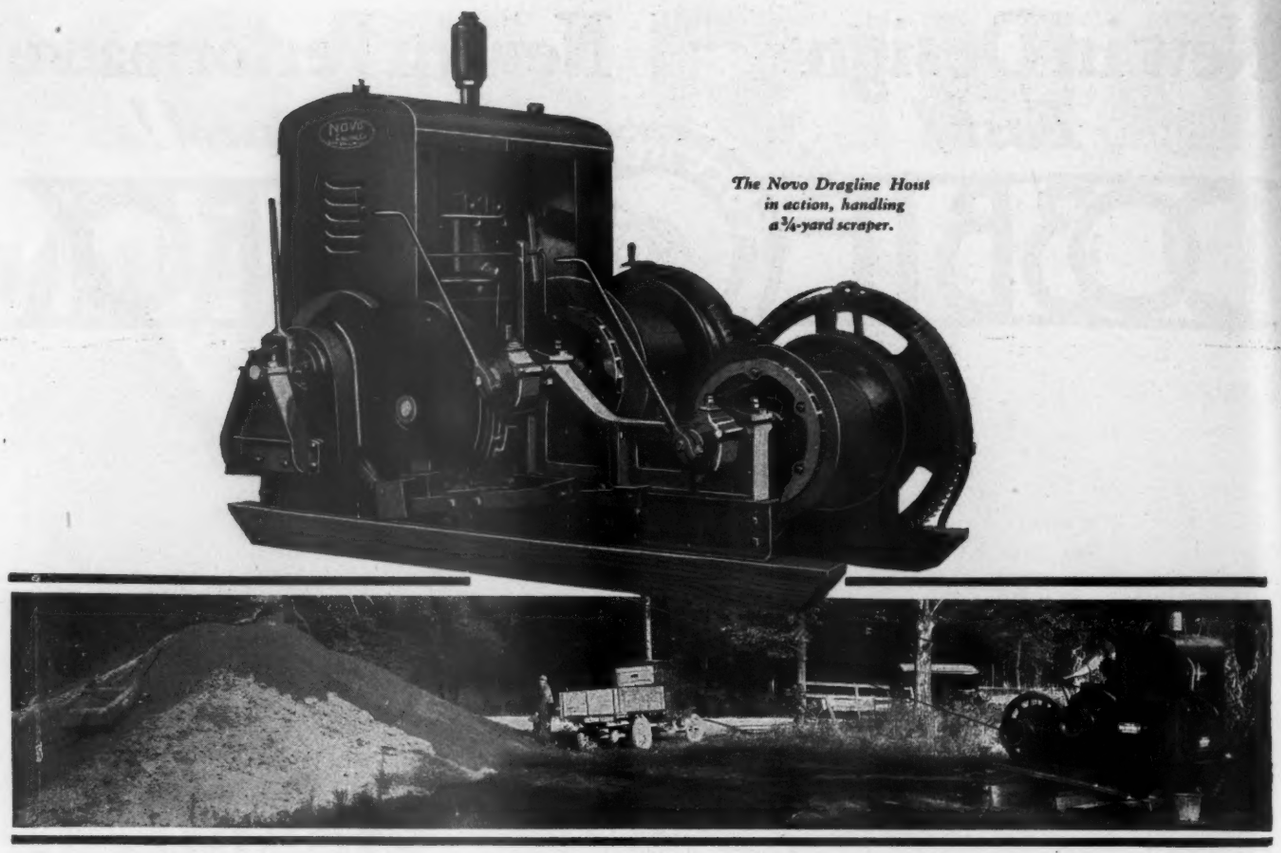
The Mundy Sales Corporation

DISTRIBUTORS FOR
THE DOBBIE FOUNDRY & MACHINE CO., Niagara Falls, N. Y.
SALES AND EXPORT OFFICE, 30 CHURCH STREET, NEW YORK

DOBBIE DERRICKS

Sheaves ~~ Hand Winches ~~ Blocks

When writing advertisers, please mention ROCK PRODUCTS



The Novo Dragline Hoist in action, handling a ¾-yard scraper.

Stripping Over-Burden . . . Digging Sand and Gravel .. *Cutting Costs*

PUT one man and a Novo DHG Dragline Outfit to work stripping over-burden—and watch the dirt *move*. The Novo Hoist provides more than enough power to assure the scraper bucket a healthy bite and a full load on every inhaul—and enough speed to make the spoil pile grow like a mushroom after a rain.

Then start this one-man Novo Outfit digging the sand and gravel. If it's handling a ¾-yard scraper, you'll see an average of 300 yards of material go through the grizzly every day—at costs as low as 3c per yard.

In addition, the Novo Dragline can show costs of a similar low vein on bulk storage and reclaiming.

A relatively low initial investment—maximum fuel and oil costs of about $4 per day—versatility that permits digging over any span from 100 to 400 feet—adaptability to either under water or dry digging. These are a few of the reasons why the Novo Dragline Outfit can dig so many yards per day at such a low cost per yard.

The *Novo Hoisting Handbook* shows you many more. Send for your copy today.

There's a wealth of interesting and valuable information on cutting sand and gravel costs in the Novo Hoisting Handbook. *Pictures, Diagrams and descriptions show in detail how Novo Outfits are working for others and what they can do for you. Send for your copy today. No Obligation.*

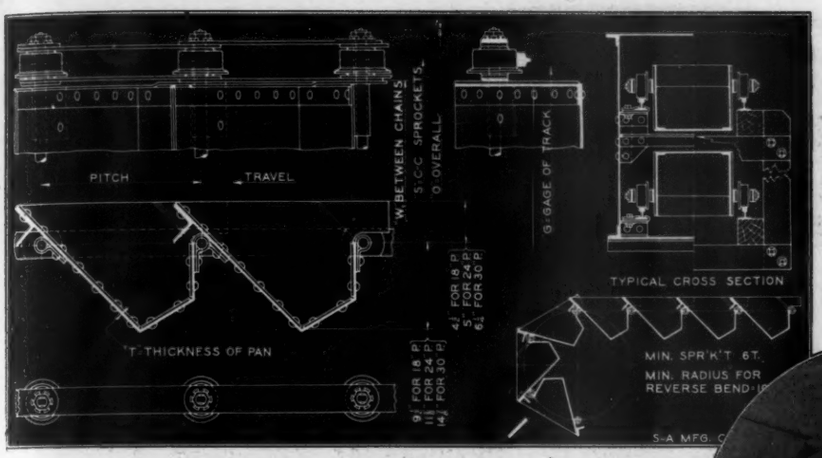
NOVO ENGINE COMPANY, 250 Porter Street, Lansing, Michigan
CLARENCE E. BEMENT, Vice-Pres. & Gen. Mgr. Service, parts and sales in over 60 cities

NOVO

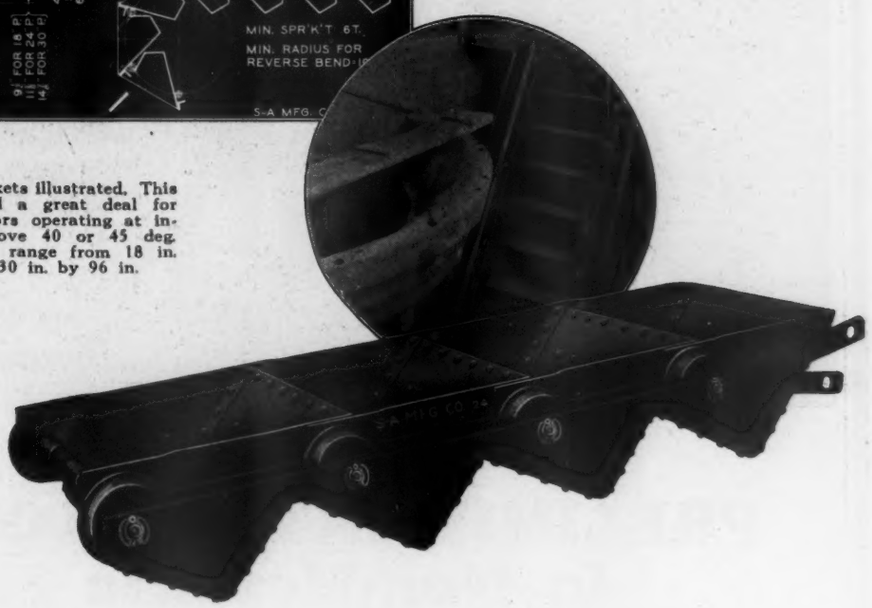
Hoists from 300 to 10,000 Pounds

Also Engines and Pumps

When writing advertisers, please mention ROCK PRODUCTS



Style "J" buckets illustrated. This style is used a great deal for heavy elevators operating at inclinations above 40 or 45 deg. Bucket sizes range from 18 in. by 18 in. to 30 in. by 96 in.



Bucket elevators of maximum Capacity and minimum weight

ALL the essentials of design are included in S-A bucket elevators for handling heavy bulk materials at large capacity.

On large and steeply inclined elevators, S-A Engineers secure the maximum possible capacity without unnecessarily increasing the weight. The large buckets are carefully reinforced to give stiffness, the lips are given sufficient overlap to prevent spillage and each type of bucket is designed to give the maximum volume for the inclination for which it is recommend.

The chains carrying the buckets are also of great importance where the angles are steep and practically the whole weight of buckets and load is supported. The working loads often run up to 20,000 or 25,000 pounds and it can be seen that the chains must be carefully proportioned to avoid sacrificing strength to save weight.

Our "8000 Class" Steel Bushed Roller Chain, which is the highest grade built, is always used for S-A heavy elevators and conveyors.

Write for details about S-A Heavy Bucket Elevators and Conveyors.

DESIGNERS AND BUILDERS OF LABOR SAVING MATERIAL HANDLING MACHINERY

STEPHENS-ADAMSON MFG. CO. Main Offices, Aurora, Ill.
Branch Offices in Principal Cities

AURORA S-A MFG.CO ILLINOIS

STEPHENS-ADAMSON

PLANTS: AURORA, ILLINOIS — LOS ANGELES, CALIFORNIA — BELLEVILLE, ONTARIO

When writing advertisers, please mention ROCK PRODUCTS

Longyear Crew Drilling Limestone Deposit for the Calcite Quarry Co., Meyerstown, Pa.

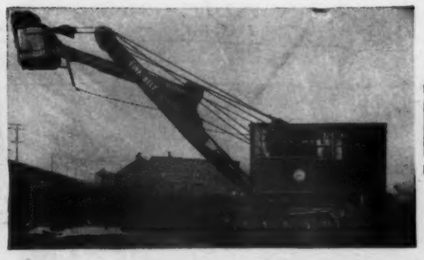
PRELIMINARY EXPLORATION In Non-Metallic Fields

THE conduct and financing of stone operations are considerably simplified by Diamond Core Drilling. Company lands may be definitely blocked out, in advance of operations, as to the quality and extent of the stone. Proper reserves, necessary to indefinitely continued production, may be kept in balance with production. As new lands are taken under option, the stone content can be valuated and worthless lands disposed of.

Diamond Core Drilling replaces assumption with facts. Operators can seek additional appropriations or outside financing with assurance because definite values are indicated on the lands being operated and in prospect, by what the diamond drill core shows.

E. J. Longyear Company diamond drills properties in the non-metallic field under contract. Longyear crews are thoroughly trained and have years of experience behind them. Unless your properties have been diamond drilled it will be distinctly worth your while to take up the matter with E. J. Longyear Company. There will be no obligation involved.

E. J. Longyear Company
Minneapolis, Minnesota, U.S.A.



You Can Measure Performance And If You Do—

You'll Buy a Link-Belt Shovel

PERFORMANCE is one thing that can be measured accurately. Any Link-Belt Shovel user will be glad to help you, for they know how profitable it is to own and operate these sturdy machines, that have lowered the cost of handling material—that have speeded up work—that have made operators satisfied with their work—that have kept trucks busier—that are always on the job. The performance of the Link-Belt Shovel has earned an enviable nation-wide acceptance by those who handle material.

To own and operate a Shovel—built and backed by Link-Belt—is to know the real reason yourself. Send for Catalog No. B 10.

3153

LINK-BELT COMPANY

Leading manufacturers of Elevating, Conveying, and Power Transmission Machinery

CHICAGO, 300 W. Pershing Road — Offices in Principal Cities

LINK-BELT SHOVEL

When writing advertisers, please mention ROCK PRODUCTS

Send for the folder that tells about it

The Close Spacing—
5-16 of an inch—between idlers on this

New Rex-Stearns Carrier
leaves no room or chance for "Belt creasing."

Idlers separately mounted and completely and quickly interchangeable.

The Improved Brackets
of a new, clean, strong design, made of *Malleable Iron*, give many advantages to this new unit that carries the

Rex-Stearns Timken-Idlers
with one-piece pulley shell either Pressed Steel—or Chilled Face Cast Iron—the most wear-resisting idler on the market today.

A New Folder describes this new Rex-Stearns Carrier. Send for your copy.

DUST STAYS OUT - - - GREASE STAYS IN

THE STEARNS CONVEYOR COMPANY
982 E. 200th STREET and ST. CLAIR AVENUE
CLEVELAND OHIO

BIRMINGHAM BUFFALO
CHATTANOOGA CHICAGO
MINNEAPOLIS CLEVELAND
DETROIT PITTSBURGH

REX
(Reg. U. S. Pat. Off)
STEARNS

Owned by
CHAIN BELT COMPANY
749 PARK STREET
MILWAUKEE
WISCONSIN

HOUSTON LOS ANGELES
SALT LAKE CITY NEW YORK
PORTLAND SEATTLE
ST. LOUIS SAN FRANCISCO

BELT CONVEYORS—IDLERS

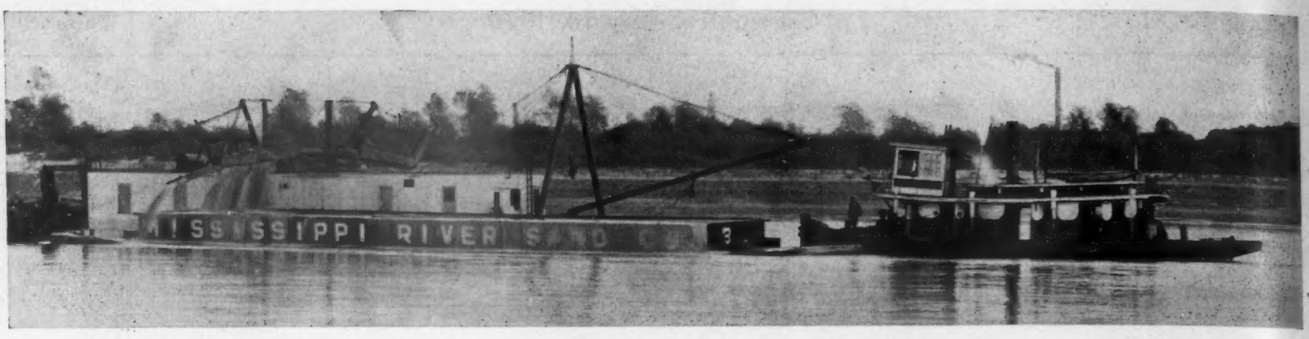
When writing advertisers, please mention ROCK PRODUCTS

Volume XXXI Chicago, February 18, 1928 Number 4

Rock Products

With which is Incorporated CEMENT and ENGINEERING NEWS Founded 1896

Unloading dock and hopper at the plant of the Mississippi River Sand and Material Co., St. Louis—part of the well-designed and effective system of handling and storing material



The dredge pumping into barges and the towboat, Mississippi River Sand and Material Co., St. Louis, Mo.

Dredging Sand Near St. Louis, Mo.

Mississippi River Sand and Material Co.'s Principal Market in Close Proximity to Its Operation and Plant

THE plant of the Mississippi River Sand and Material Co. of St. Louis, Mo., is at the foot of Victor street. The sand which it sells is dredged from the Mississippi river immediately in front of the plant, making a combination of supply and market that most large city producers will regard enviously.

The process employed is very simple. The material dredged is the flowing sand which the current of the Mississippi keeps slowly moving along the bottom of the channel. In a way the deposit may be said to be inexhaustible, as the high waters each year bring in what is taken out during the season. The sand as pumped from the river bottom is clean and free from trash, so that it can be placed on the market without further preparation. The grading by the current of the river and effected in the sand chutes takes out unwanted fines along with the clay, leaving the mesh sizes wanted for concrete and general building purposes.

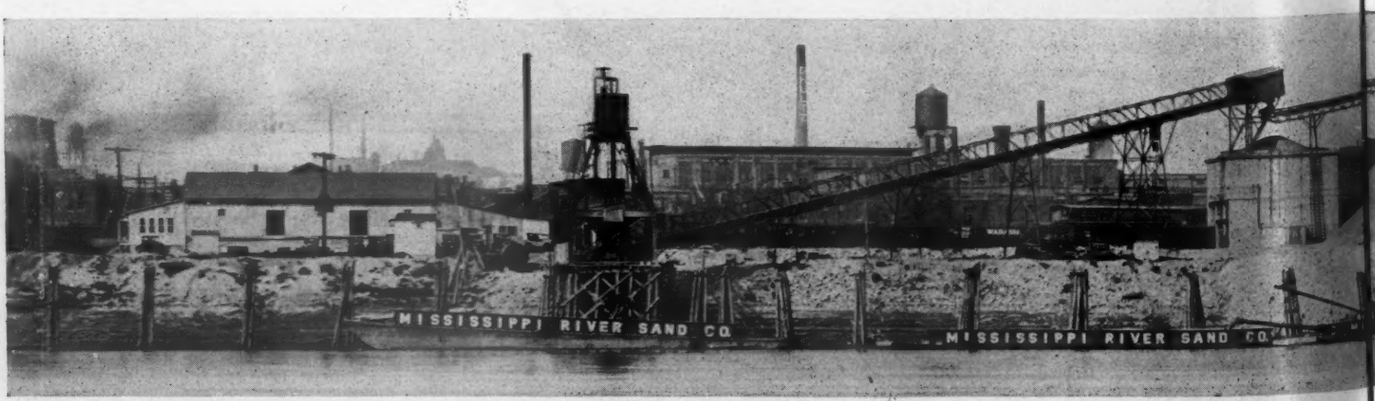
The layout consists of a dredge pumping into barges, an unloading plant and a storage system and all three are remarkably well designed and constructed. The dredge is of all-steel construction and Diesel powered, the unloading plant is not only well designed and equipped but has ample capacity for the rapid unloading of barges, and the storage plant is rather a model of what such plants should be. All the structures and the loading bin are of steel or concrete and placed on concrete foundations. Storage for gravel, which the company secures from the Merimac river, is provided as well as storage for sand.

The Dredge

The dredge was built by the Midwest Barge and Boat Co. of Grafton, Ill. The hull is 100 ft. long, 26 ft. wide and 4 ft. deep and it draws 24-in. when fully loaded. Sides, deck and bottom are of ⅜-in. steel plate. The hull is stiffened by eight longitudinal and two transverse bulkheads, the fuel tanks being behind bulkheads at the side. For examining the interior of the hull there are hatchways closed with circular plates that screw into place. All the machinery is in a cabin which is made of No. 8 steel plate on a frame of light structural steel.

The prime mover is a Fairbanks-Morse full-Diesel Type Y engine, a type which has been installed in a number of dredges built recently. On the shaft of the engine is mounted a 47½-kva., 3-phase, 60-cycle, 240-volt Fairbanks-Morse generator. Beyond this is a Cutler-Hammer magnetic clutch, connecting the engine shaft to the pump shaft. The pump has a 15-in. suction and discharge. It was made by the Morris Machine Works and has manganese steel wearing parts. For exciting the generator there is a Fairbanks-Morse direct current generator driven by a Link-Belt silent chain from the main shaft and this also supplies current for the magnetic clutch. A 3-in. motor-driven centrifugal pump supplies circulating water for the engine and also primes the big pump. A flap valve in the suction may be used to close the suction when priming, but this is seldom used, the raising of the suction above water being enough to put the pump in a "pocket."

There are two hoists, one for handling the anchor lines which hold the dredge in place and the other for handling the suction. Both were made by the O. K. Clutch and Ma-



View of the plant from the river, showing, from left to right—

chinery Co., Columbia, Penn. The anchor line hoist has a 20-hp. motor and the suction hoist a 15-hp. motor, current being furnished by the generator on the engine shaft.

Long Suction Employed

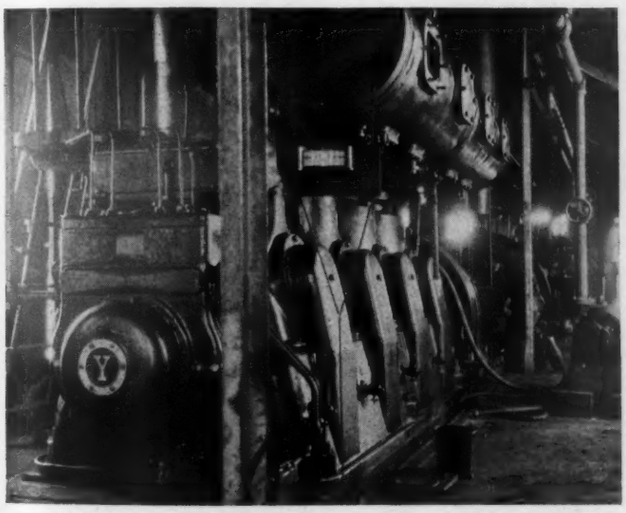
The boom is 60 ft. long, made of structural steel lattice work, and it is fixed in position. It has to be rather strong, for the suction is unusually long. Much of the time the sand is pumped from 60 ft. below the water. The suction is of welded steel pipe and all the flanges are welded on, which helps to stiffen the suction as well as to provide against leaks. The suction line is received through the pulleys on the boom with the usual four part arrangement. A flexible joint, of the company's own design and built in its shops, connects the movable suction with the suction pipe of the pump. It is built up of wedge shaped flanges with soft rubber fillers, and the elasticity of the rubber allows sufficient movement of the suction without danger of leakage. At the end of the suction there is the usual bonnet with a grating of rods to keep out trash and large pieces.

The discharge of the pump rises to a Y on top of the cabin and either branch of the Y may be shut off by a simple sliding gate. Barges are loaded on either or both sides, the branch of the Y not in use being closed off when only one barge is being loaded. The loading chutes are of steel, each swung from a light steel boom derrick. There are three openings in the bottom of each chute protected by screens that keep out trash and oversize. The passage of the water through the chutes effects a rough classification, grading the sand so that the fines and trash flow over the screened openings and go out at the end of the chute, beyond the barge and into the river. The system is one which has long been in use in dredging sand from the rivers of the Mississippi valley region.

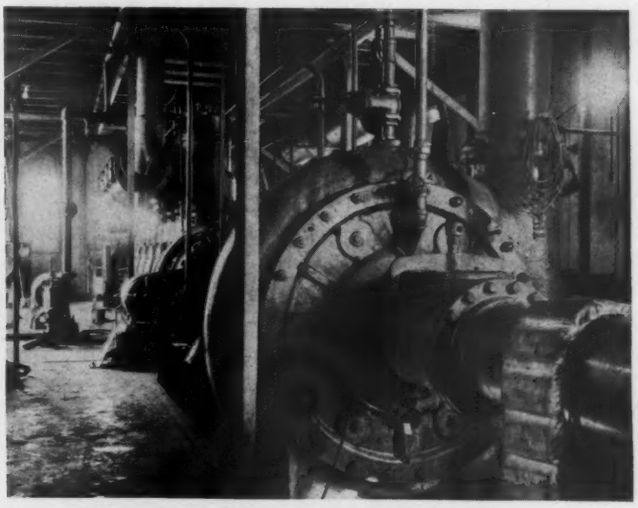
One of the all-steel, flush-deck barges with the towboat alongside

The operator stands by the suction hoist and uses the hoist levers and a set of push buttons to control the different machines. He does not have to leave his post because the magnetic clutch is timed so that the "pick-up" is at the right speed. This also allows the engine to be run at constant speed all the time. The need for a clutch between the pump and engine is denied by some operators, but the operator of this dredge says that it is almost indispensable in rough water, such as this dredge often has to encounter in the broad spaces of the St. Louis harbor.

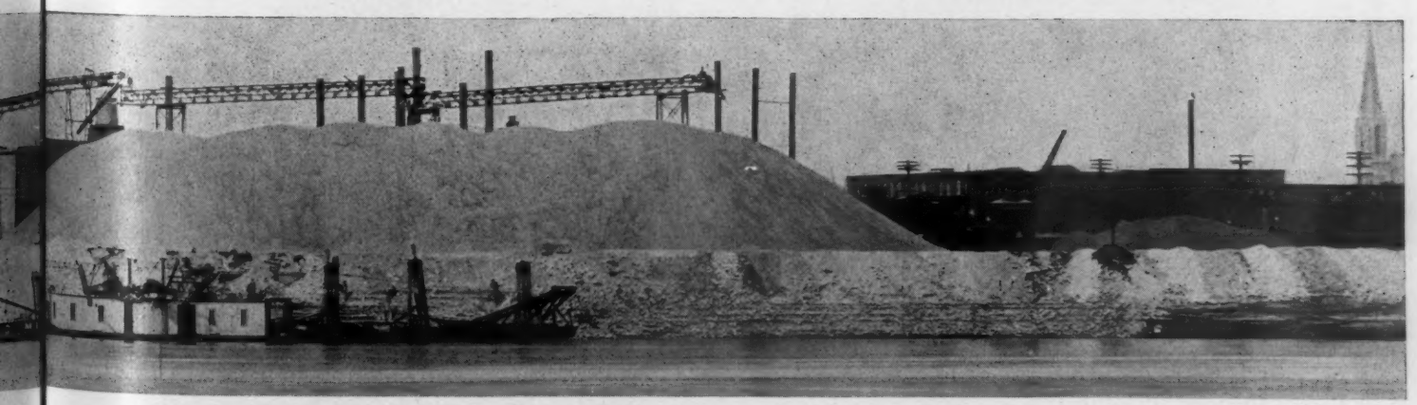
The cost of pumping sand with a dredge of this type is almost unbelievably low. Rec-



Interior of the dredge cabin—engine end



Pumping end of the dredge interior



office, unloading dock, elevator to bin and the storage pile

ords kept since August, 1926, when the dredge started operation, show that repairs had been a little less than $30 for the first year, excluding the cost of lines and cables. The weekly costs of operation cover such items as: Labor, including one engineer, one pump man and assistant and one deck hand; supplies, including 840 gal. fuel oil at 6c. and 7 gal. lubricating oil at 60c., $54.60. This is based on steady running, 9 hr. per day.

The dredge will fill one of the standard barges of the company, which holds 575 tons, in about 1 hr. 20 min., average pumping time. It can produce seven full barges per day if called upon to do so. The lowest recorded time for filling a 575-ton barge is 55 minutes, and the allowance of one hour and 20 minutes per barge includes time lost because empty barges were not ready and because of other reasons. The company's requirements, at the present time, have been only about four barge-loads per day.

The barges employed are of all steel construction and of the flush deck type, built by the Dravo Contracting Co., Pittsburgh, Penn. Barges are handled alongside of the dredge by ropes which are run to a cathead on the hoist that handles the suction.

The barges are towed from the dredge to the dock by one of the company's tow boats and unloaded there by a traveling crane made by the McMyler-Interstate Co. A 3-yd. bucket is suspended from a trolley which runs on rails that extend over the barge. After it has picked up its load the bucket is run back over a steel hopper that holds 50 tons, below which is a Stephens-Adamson feeder that feeds the sand on the first of the conveyor belts that handle the sand to storage.

The bucket is handled by a three-drum hoist which is driven by a 135-hp. General Electric motor. There is a 20-hp. auxiliary hoist which runs the bucket in and out on the rails over the barge. These hoists and motors are in a cabin on the crane structure and in this is the switchboard on which are the automatic contactors by which the speed of the motor is built up. The switchboard is also of General Electric make.

Storage and Handling System

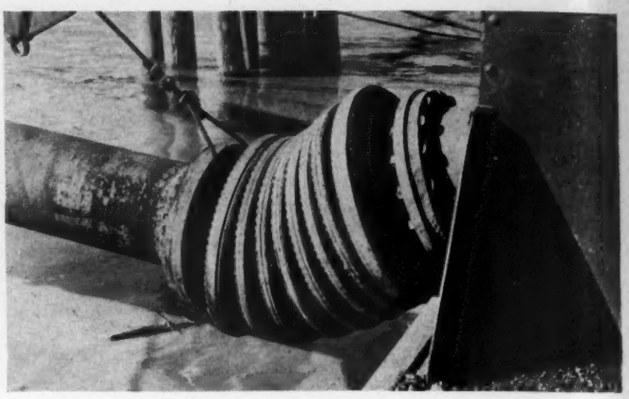
The storage and handling system was designed by the Stephens-Adamson Co., and while it is simple in its method of operation it is effective and about as well constructed as such a system could be. All the belts are carried on steel trusses and the trusses are supported on concrete foundations. The whole ground around the unloading crane and the start of the belt system has been covered with concrete as a part of this foundation, which is on made ground.

The feeder below the hopper is a short belt of about 20 ft., which discharges to a 300-ft. inclined belt that rises about 50 ft. to a point above a concrete bin which holds about 2000 tons. The bin is 40x42 ft. inside and is placed over two railway tracks and a road on which trucks are run through to be loaded. This bin is exceptionally well constructed, as it contains 140 tons of reinforcing steel. There is a 2-ft. concrete slab under it and all around it and track scales are placed under all of the tracks. Over the road where trucks load is a measuring device to serve as a batcher when batched loads of sand and gravel are to be delivered. Unbatched truck loads are weighed at the office, where the weight is indicated and recorded on an automatic "weightograph."

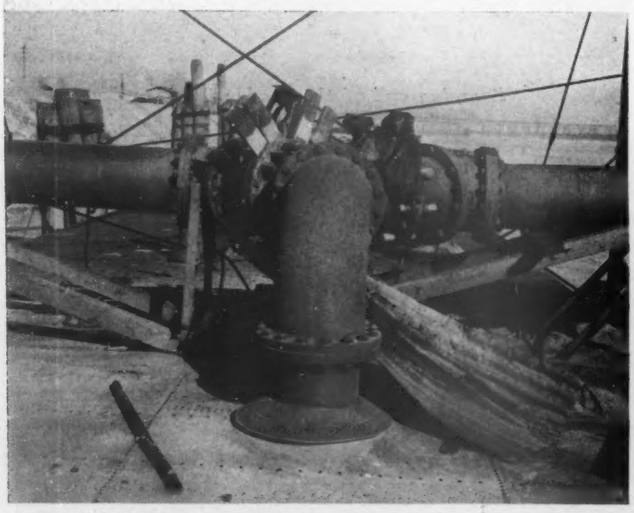
Under each bin compartment are Stephens-Adamson slide gates, operated from a walkway and steam heated to prevent freezing in the winter.

The inclined belt that fills the bin can dis-

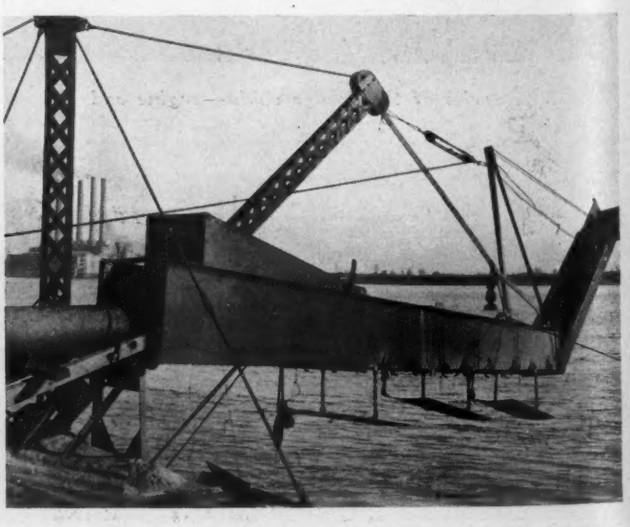
Valve in suction, used in priming



One of the flexible joints in the suction line

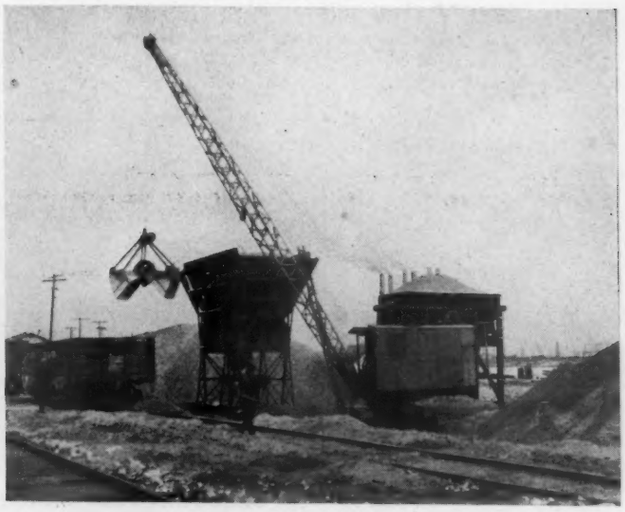


The "Y" on top of the cabin through which pump discharge is sent to loading chutes



Steel loading chutes with screened openings in the bottom for grading the sand

Office building—sand storage in background



Gravel storage with batcher and the loading bins

charge into swinging chutes that throw the sand on either side of the structure, or ahead, to form the start of the long storage pile. The remainder of the pile is built by three 100-ft. belts in series. Each of these is set so that it can discharge three ways, to chutes that throw the material to the side or ahead, to build the storage pile, or straight

Unloading dock and crane

ahead, in which case the discharge falls on the next conveyor, except in the case of the last one in line. By this simple arrangement the entire storage space can be covered with a broad pile of uniform depth, as the pictures show.

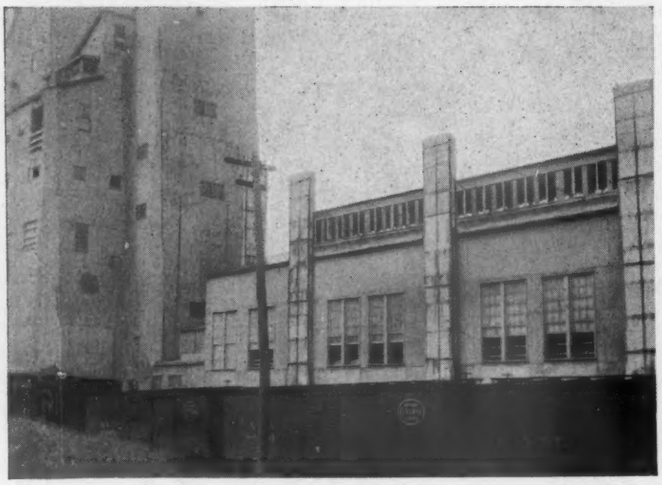
All belts are 30-in. wide and are carried on steel trusses, which are supported on towers of structural steel. This makes a rigid structure which is one of the important factors in securing long life and continuous operation to a belt. The troughing rolls and idlers are Stephens-Adamson "S-A" unit carriers with Timken roller bearings. Each unit is arranged for grease gun lubrication.

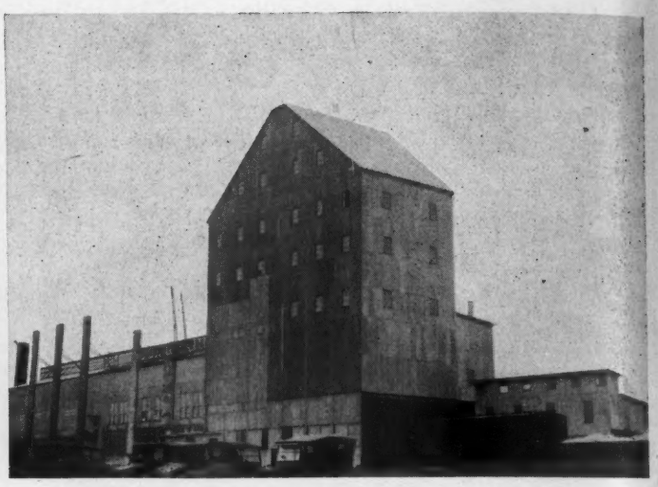
Sand is recovered from storage by a McMyler-Interstate crane or a Barber-Greene loader, and originally no means of putting sand from the storage pile into the bin was provided. But when the plant was visited early in December to obtain the notes for this an elevator for loading bins was being installed. This elevator was to take sand from a pit into which sand was to be loaded by the loader. The gravel storage is beyond the sand storage. Gravel is received in cars and handled in and out of storage by a McMyler-Interstate crane. An E. S. Johnson steel bin and batcher is used for truck loading. An 8-in. reinforced slab is placed below it so that the ground will not be cut by trucks driving over it.

Recovery from the storage piles is either by a McMyler-Interstate crawler crane or a Barber-Greene truck loader. No arrangements for loading the bins from the storage pile were installed originally but work had begun on such an installation. A pit was being dug for a hopper which would feed a bucket and belt elevator lifting sand to bins.

The office of the company is at the plant and the officers are: Edmund Koeln, president; Michael Hendy, treasurer, and Judge C. H. Daues, secretary.

The 2000-ton concrete bin, provided with batcher for trucks and track scales for loading cars





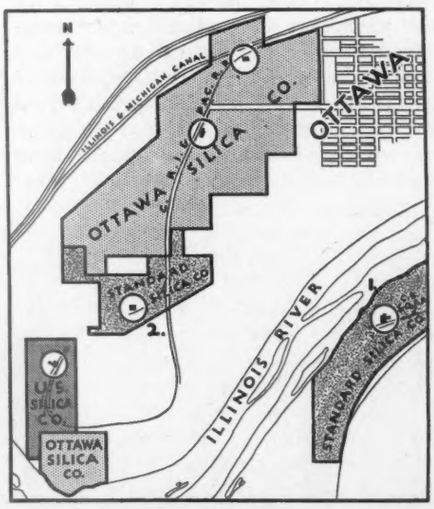
Plant A of the Ottawa Silica Co., one of the largest producers in the Ottawa, Ill., district

Silica Sand Plants at Ottawa, Ill.

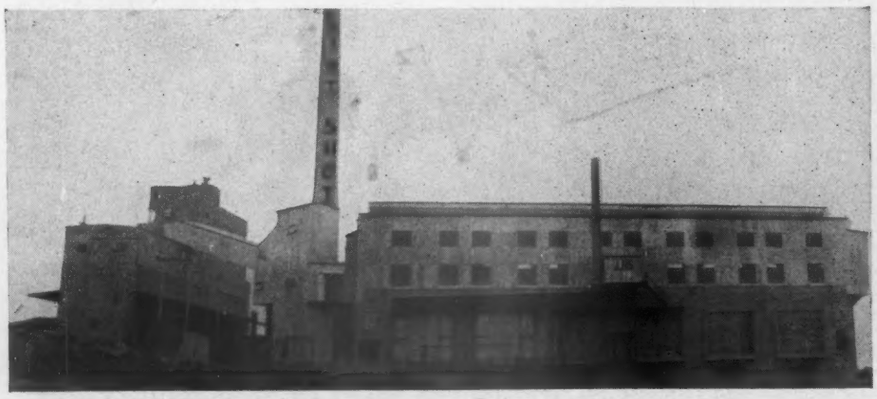
General Practices in One of the Largest Producing Areas in the United States

THE Ottawa district is the largest producer of silica sands in Illinois, the industry being confined for the greater part to Ottawa, Wedron and Utica. The deposits at these places are very well known and have been worked for a great many years, consequently the pits and plants are in a high state of development. There are a large number of operations producing "crude" silica sand which is shipped in an unwashed, damp state to other plants or consumers located in various states. Only three companies, Ottawa Silica Co., U. S. Silica Co. and Standard Silica Co., are engaged in the production of classified silica sand and of these only one, the Ottawa Silica Co., operates pulverizing plants. A fourth company, the Wedron Silica Co. at Wedron, seven miles from Ottawa, also has a pulverizing unit.

All the companies work the St. Peter's sandstone (Ordovician) which occurs at or close to the surface in Ottawa and farther down at Wedron. Stripping at all the plants is with a crawler power shovel to remove the major part and hand shovelling to get inaccessible portions. At the Ottawa Silica Co. the shovel loads to a pneumatic-tired motor truck equipped with a special 1¼-yd. all steel body. The Wedron Silica Co. loads its strippings on 4-yd. dump cars running on a narrow gage track. Further cleaning is



Map of Ottawa district showing location of some of the principal operators



New plant of United States Silica Co., Ottawa, Ill.

Plant B, Ottawa Silica Co.

Cleaning stripped surface with compressed air jets

Pneumatic tired motor trucks used in stripping operations

by means of scrapers and brooms and at the Ottawa Silica Co. with compressed air jets. All mud or clay holes are cleaned out so as to carry as little as possible of foreign matter to the washing plants.

Usual practice in the district is to put down drift holes to a depth of from 20 to 30 ft., ending in a pocket at the bottom in which the whole charge is placed. The sandstone after blasting is easily broken down by the hydraulic nozzles. Stripping and blasting are carried on as much as possible in the fall, for the freezing during the winter helps disintegrate the sandstone. The Ottawa Silica Co. protects the stripped top surface of its quarry from freezing by a simple method—holes 8 ft. deep and 6 ft. on center are drilled and shot in the fall so as to leave a layer of soft sand over the solid rock. The advantage of this lies in that it permits quarry operation in the winter and early months of the year, the frost not penetrating below the blasted top surface.

As might be expected, much of the other practice in the district is common to all the plants. The recovery method which follows is typical. A hydraulic monitor (¾ to 1-in. nozzle with 125 lb.-150 lb. pressure) plays on the face of the quarry and washes the sand to a sump at the foot. The sand and water from the sump are pumped by Knowles steam pulsometers through 5- or 6-in. iron pipes to the plant which in some cases may be almost a half-mile distant. The individual pumping stages are for only a few hundred feet, each pulsometer pumping to a sump. The pipe line discharges to the plant sump where the sand along with some water is conveyed by a peculiar form of conveyor known as a "Chinese drag" to the washing plant. This is an endless rubber belt 24-in. wide to which 2x4-in. wooden cleats with added 1½-inch wearing strip placed 12-in. apart are fastened on the downside of the belt. The cleats run in a wooden trough and carry the sand up the incline, most of the water running back to a reservoir below. The length of this conveyor varies at the different plants, but is usually not less than 250 ft. long and on a 25 deg. incline. The speed is about 600 ft. per minute. At the Ottawa Silica Co. a 50-hp. General Electric motor with Tex-rope drive operates the conveyor.

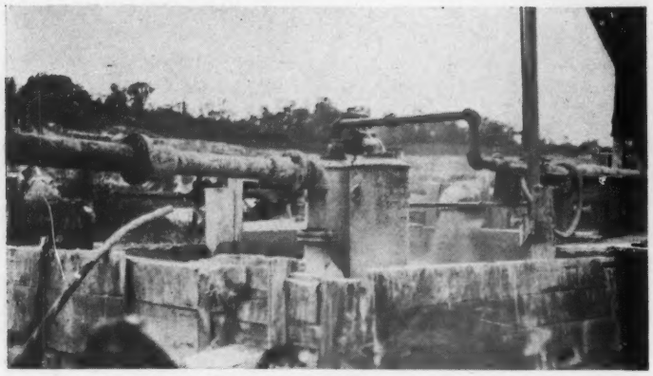
Hydraulic operations—typical of the Ottawa district

Stream with 150 lb. pressure tearing down the bank

No crushers are necessary to reduce the sand to grain size, the force of the water from the hydraulic monitor and pumping action of the pulsometers being sufficient to accomplish the disintegration. All the plants use centrifugal pumps, electric driven, to supply water to the hydraulic monitor.

Ottawa Silica Co.'s Plants

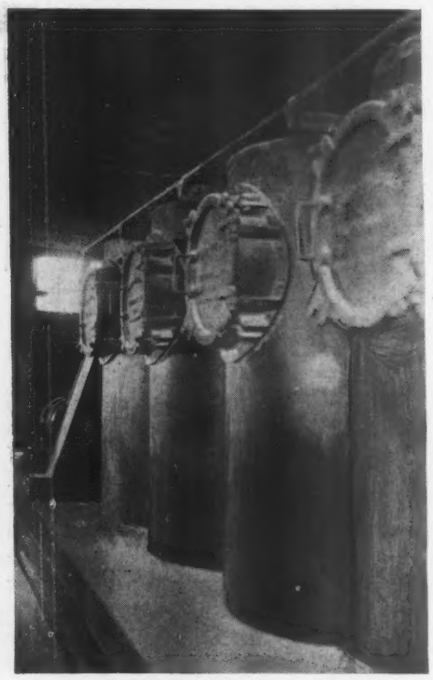
The washing procedure differs at the plants so for the purpose of simplification, each plant's details will be considered individually. The first of these, plant A of the Ottawa Silica Co., uses a rotary screen, 12 ft. by 36 in. in dia. with wire cloth, ⅛-in. mesh. The oversize is chuted to waste and the throughs pass to two large wooden tanks in which they are washed with jets and a



Steam pulsometers pumping to the plant sump

"Chinese" drag conveyor carrying sand to washing plant

hose. Silt and mud are floated off and the washed sand mixed with water and passed to two other bins where it is treated in similar manner, after which it is pumped to four large concrete drainage bins, each about 38 ft. square and 12 ft. deep, holding about 1400 tons of drained sand. These bins are fitted with water sprays for washing and a workman also washes the sand in them with a powerful nozzle. The bottoms of these bins have layers of cinders or gravel and cinders over which is placed a grizzly of rails to stop the reclaiming bucket from digging into this filter bed. A 5-ton Harnischfeger electric crane with 2½-ton Williams bucket digs the drained sand from the bins and carries it to the dryers running alongside the drainage bins.



Cylindrical dust collectors at the Ottawa Silica Co.

There are six steam dryers, all of the Lewistown type, fitted with separate stacks for the escape of water vapor. Each dryer is about 20 ft. long and 6 ft. wide with 14 tiers of steam pipes, each tier fitted with entrance and cut-off valve so as to cut it out of the system in case of leak. The capacity of each is about 20 tons per hour. Dried sand falls through the bottom of the dryers to a conveyor belt running underneath which carries it to the boot of a belt and bucket elevator running to the dry screening plant.

All Hum-mer vibrating screens are used to separate the 10 different grades of silica sand which range from 60-mesh to 30-mesh. The screen cloth is all of Monel metal to resist the abrasive action of the sand. A feature of the screening plant is its dustless condition brought about by the installation of Allis-Chalmers cylindrical collectors. Other collectors of similar make have been installed on the second floor of the screening plant and on the bagging machines. All collectors are driven by Allis-Chalmers motors and short center Tex-rope drive.

The important grades of screened sand, in the order of coarseness, the coarsest being first, are given below:

"Diamond" sand blast sand.
No. 2 sand blast sand.
Stone sawing sand.
Coarse foundry sand.
No. 1 glass sand.

Battery of electric vibrating screens at Ottawa Silica Co.

Wooden bin for preliminary washing

Washing sprays over the concrete drainage bins

"Federal" fine sand.

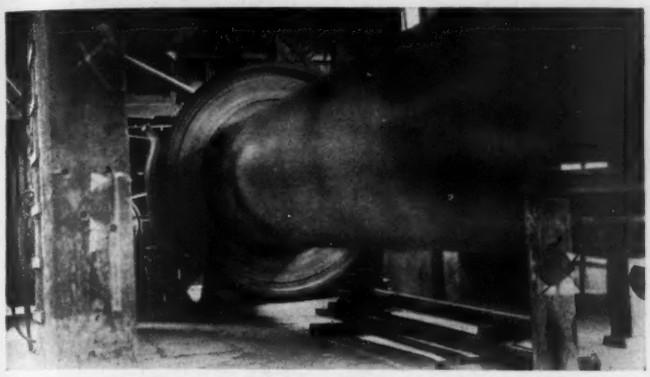
Banding sand.

The fines from the screening plant are used to make pulverized silica. Two rotary ball mills of West Pulverizing Machine Co. make are installed in the pulverizing plant. One of these is 25x5-ft. diam. and the other 25x6-ft. diam., the drives being 60-hp. General Electric motors. Grinding is carried to 140-mesh, this product being carried from the mill to a belt and bucket elevator and brought to storage bins in the bagging room. Dust from the mills is collected and carried to a special bin for soap grit, etc. A Bates two-spout packer is used to bag the product when paper bags are desired, and several home-made packers serve to fill cotton bags.

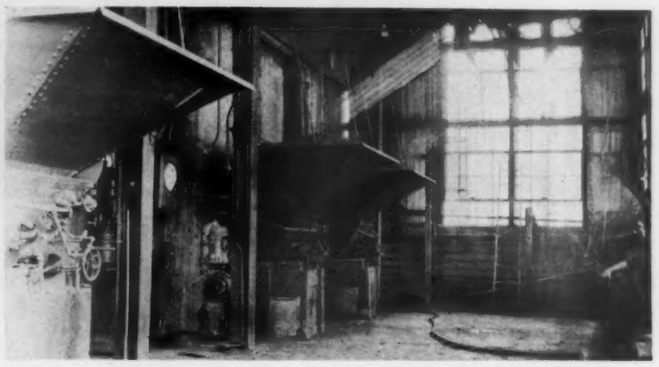
Much of the sand used in testing laboratories and adopted by the A. S. T. M. as the standard sand for cement testing is made in a special building at the Ottawa plant. The oversize from the 30-mesh Hum-mer screen is sent to this building, where it is passed over small 20-mesh wire cloth shaking screens. The throughs of this screen are then screened over a 30-mesh gyrating screen and the retained sand collected as a standard sand, through 20 and retained on a 30-mesh sieve. In bagging, the sand is poured on an inclined wooden trough over which horseshoe magnets are placed to collect any iron accidentally introduced. This standard testing sand is the coarsest grade produced.

The power plant is quite modern and contains 3 Babcock and Wilcox 300-hp. boilers, each equipped with Combustion Engineering Co. type E stokers. Two more boilers of the same type are being added. Coal to the stokers is supplied by a Brownhoist feeder running on a monorail along the boilers. All the electricity used in the plant for lighting and power is generated from several generators of Allis-Chalmers and General Electric make.

The general operation features of the No. 2 plant of the Ottawa Silica Co. are almost identical with No. 1 plant. The combined capacities of both plants is about 3000 tons per day. Operating personnel for both plants comprises P. S. McDougall, general manager; Joseph Gyger, superintendent; W. B. Gyger, assistant superintendent. E. B. Thornton is president and G. A. Thornton, secretary-treasurer.



Rotary ball mill for pulverizing silica—Ottawa Silica Co.



Automatic stokers on the boilers—Ottawa Silica Co.

Bucket reclaiming sand from the concrete drainage bins —U. S. Silica Co.

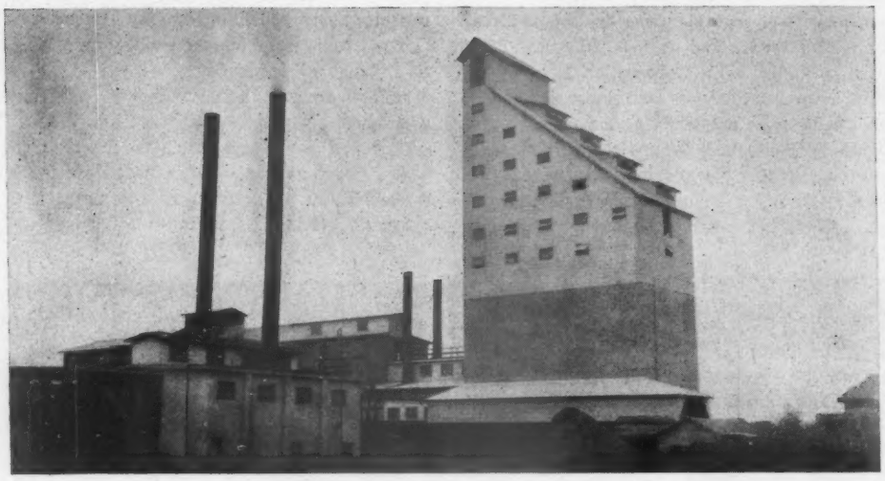
Electric motor and speed reducer drive on a sand elevator— U. S. Silica Co.

Recently Completed Plant of the United States Silica Co.

The United States Silica Co. has two plants, adjacent to each other, the older of which is now held as a reserve. The new plant was put into operation only a short time ago and has quite a few features not to be found in any other silica sand plants in the country. As noted before, operation principles do not differ radically at any of the plants in the district, but there are several refinements in operation which are notable at the different plants observed.

The quarry contains three different grades of silica sand which are worked in independent manner to supply the washing plant with sands of grain-size desired at the time. Hence the first separation is made in a rough way at the quarry. The scalping screen is flat, with 6 to 12 mesh opening, throughs passing to concrete wash bins with adjustable overflow baffles over which the wash water and dirt pass. The washed sand is pumped to any of four concrete drainage bins, each 40x35 ft. and 17 ft. deep. These bins are deeper than those at the Ottawa Silica Co. plant and have a different bottom construction, the usual filter bottom having been replaced by nine filtering pots with removable cylinders, each of which can be independently drained. The filter medium is several layers of cinders and gravel, packed in graded sizes, the whole covered with a screen. By dividing up the filter bottom, clogging becomes a matter easily and economically dealt with, for the whereabouts of the clogged sections are readily ascertained and replacement made without tearing up the whole filter bed. An overhead crane with 2-yd. bucket serves the drainage bins and dryers.

There are six dryers, all of the Lewistown type, using a combination of direct drying from the steam coils and preheated air with forced draft. The air is preheated



Plant No. 2, Standard Silica Co.

by passing through an Aerofin electric heater and delivered to the dryer at any of several points along the width. The possibilities of recondensation of evaporated moisture anywhere in the dryer is lessened by this method, according to W. J. Witt, superintendent of the company, who originated the scheme. The wet and dry bulb recording thermometers furnish a more accurate guide for dryer operation than usual.

There is every evidence that the company has built a truly modern silica sand plant. All the buildings are of steel and concrete with "Armco" galvanized iron siding. All the machinery is electrically operated, Westinghouse motors used throughout. Elevators and conveyors are driven through Jones speed reducers.

The screening plant has 26 Tyler "whiptaps" on which three grades are made as follows:

Retained on 40-mesh (sand blast sand).
Through 40, retained on 60 (glass sand).
Through 60 (producer grade).

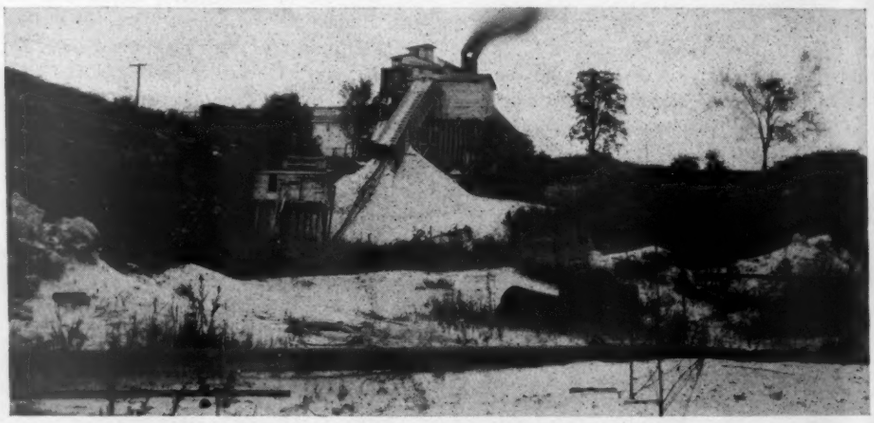
Storage for 4200 tons is provided by the 10 concrete bins from which cars are loaded by gravity through flexible pipe. Present plant capacity is about 1200 tons per day, which will be increased to 3600 tons when the other four dryers are installed.

Standard Silica Co.

Like many of the operations in the district, this company has two plants, but in this instance they are at some distance from each other and there are also two separate quarries. Plant No. 2 was formerly the Crescent Silica Co. and was purchased by the Standard company in 1925. The principal changes made were in electrifying the entire operation, including the quarry (excepting the pulsometers), where two 300-g.p.m. American Well Works centrifugal pumps were recently installed in the pumphouse.

The drainage bins at this plant are smaller in size than the others previously described, each holding but 85 tons. They are arranged in two rows of eight each, the space between being a long wooden hopper-bottomed bin with several gates along its length. The drainage bins are also hopper-bottomed, so that after the sand has drained, side gates are opened and the sand falls to the hopper bin underneath. The filtering medium for the drainage bins is broken glass, the reason being that cinders break up too easily and clog the filters. The drain pipes are threaded to permit the attachment of a hose to force water up through the beds into the sand in case clogging occurs.

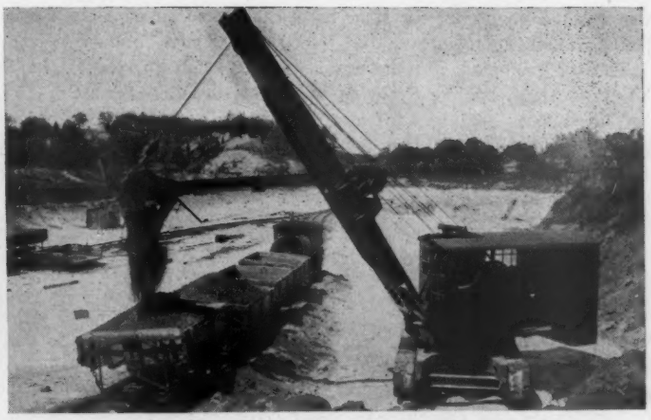
From the bin between the drainage bins the sand is carried to a distributor over the dryers. This distributor is a Robins tripper feeder with a capacity of 65 to 70 tons per hour. The steam dryers are of the usual Lewistown type. There are also four drainage bins equipped with outloading gates for



Part of the deposit and plant No. 1, Standard Silica Co.

General view of the deposit and plant of the Wedron Silica Co., Wedron, Ill.

Sand carrying lines, Wedron Silica Co.



Stripping overburden, Wedron Silica Co.

shipments of damp sand, ⅛-in. down, for wet molding.

The dried sand is elevated to the top of the screening plant and falls on a 40-ft. by 40-in. flat scalping screen, the oversize of the 20-mesh screen going to waste and the throughs passing to home-made wooden vibrating screens and Hum-mer screens. Some of the grades of sand made include:

Sand blast sand, 30- to 40-mesh.
Glass sand, 40-mesh.
Foundry sand, through 40, retained on 50.
Abrasive sand, all through 50-mesh.
Placing sand (two grades).
Sand for silicate of soda manufacture.

The No. 1 plant of the Standard Silica is south of Ottawa and is one of the older operations in the district. Quarrying is carried on in typical manner, but the company is experimenting with manganese steel centrifugal pumps to replace the steam pulsometers. The washing plant contains two 80-ton washing bins fitted with water sprays in which the dirt and clay are removed by flotation. The washed sand is then pumped to 20 wooden silos, each of 70-ton capacity, with cinder bottoms, which at this plant are the drainage bins. A gate near the bottom releases the drained sand to a conveyor running to the tops of five Lewistown type steam dryers. Dried sand falls to a conveyor underneath the dryers and is carried to eight storage bins, four of 200-ton capacity and the rest holding about 160 tons each.

Dust collector on roof of pulverizing plant—Wedron

A reclaiming conveyor takes the dried sand from the bins to a bucket elevator emptying to a scalping screen at the top of the dry screening plant. There are 23 8-ft. by 30-in. single-deck vibrating screens of the whip-tap type, all driven by line shaft and jack shafts from a single 40-hp. electric motor. The screens are arranged on several floors, the different sizes proceeding by gravity to the screens on the floors below where other separations are to be made.

Washing and screening buildings of plant No. 1, Standard Silica Co.

Wedron Silica Co. Plant

The Wedron Silica Co. has a plant and quarry at Wedron, seven miles from Ottawa. With the exceptions noted further in this article, the operating methods of the Wedron company are similar to those used at Ottawa plants. The deposit covers an area of 150 acres and the quarry has been developed over a period of six years, so that it now has a face over 100 ft. high. A ¾-yd. Link-Belt crawler shovel and Western 4-yd. dump cars are used to remove the rather heavy overburden. The cars are hauled to a dump by a 15-ton Whitcomb gasoline locomotive. Mining methods (hydraulicking), pumping and conveying to

Looking down into one of the new sand dryers—Wedron

the washing plants are the same as at other plants described above.

The washing plant has the usual washing bins and four concrete drainage bins, each holding about 1000 tons of drained sand. Four Lewistown-type steam dryers, each 20 ft. long and 8 ft. wide, are arranged along the lengths of the drainage bins. These are of all-steel construction, a departure from those in other plants, which in nearly all cases had concrete filling hoppers and encasing sides. The moist air from the dryers is drawn out by a Buffalo No. 6 fan driven by a 5-hp. General Electric motor. There are no outside stacks or vents and each dryer is equipped with a special shaking arrangement to prevent plugging by wet sand. A 5-ton Pawling and Harnischfeger overhead electric crane and 2-yd. Dreadnaught bucket are used to fill the dryers. Capacity is about 50 tons per hour from the four dryers.

The dried sand is elevated to a rotary scalping screen in the dry screening plant, which makes four separations, the largest (3/16-in.+) being discharged to waste. The throughs pass to Hum-mer vibrating screens for sizing. A good deal of the finer sand is ground to pulverized silica. Two Allis-Chalmers pebble mills are used for the fine grinding. The mills are 21 ft. long by 6 ft. dia., equipped with water-cooled bearings and driven by individual 150-hp. General Electric motors. The ground silica is elevated to a rotary screen covered with 5-mesh wire cloth to remove any broken pebbles. All sizes from 80-mesh to 300-mesh are produced, the latter being chiefly the collected dust.

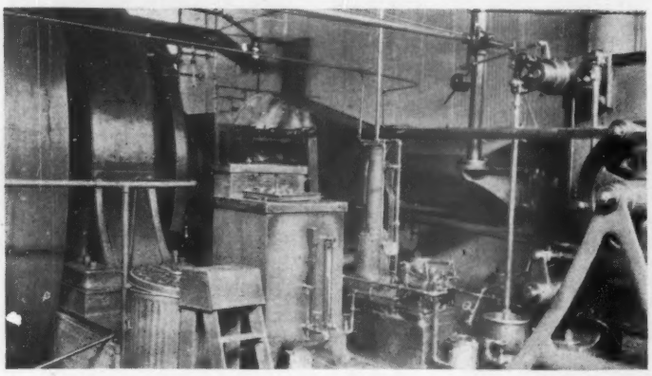
The bagging room is equipped with home-made baggers, described in the Hints and Helps pages of November 12, 1927. Sacks are usually of jute or burlap, carefully cleaned, sorted and repaired before use. A W. W. Sly dust arrester on the roof of the pulverizing plant gathers the dust from the pulverizers, sackers and bag cleaner and returns it to a separate bin. A small room has been set aside as a sample room in which the various grades of pulverized silica and sands are arranged in wall bins. There is also a physical testing laboratory in which a Ro-Tap machine, pan balances and other equipment have been installed.

The plant resembles more a large industrial operation than is usual among small rock products plants. For instance, its machine shop, has a drill press, emery wheels, shapers, a welding machine, and is otherwise well equipped to carry out plant repairs. The stockroom carries over $5,000 worth of supplies, neatly arranged and sorted into racks, all of whose contents are easily identified. And there are all sorts of auxiliary tools such as a pneumatic hammer, portable electric drill and others.

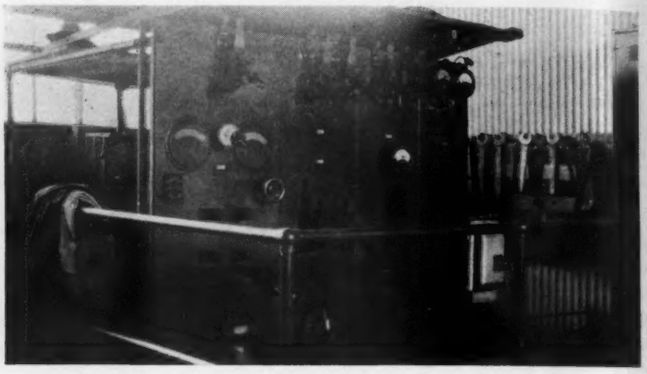
Like many of the other plants, the Wedron company generates its own electric power and its power plant is one which can stand comparison to any in the country. It is housed in a separate building, all parts of which are kept in a spotless condition. The generating units look as if they had been well taken care of, even the brass guard rails surrounding them carrying a high polish.

Two Heine boilers, one of 400 hp. and the other 285 hp., each equipped with a set of Illinois chain grate stokers, furnish the steam for the Corliss compound engine which is direct connected to a Crocker-Wheeler 400-K.v.a. motor generator. The Carrick control system has been installed to operate the stokers.

A. Warsaw is president and general manager; E. F. Swift, Jr., secretary, and John A. Dummett is superintendent and E. Eick, plant foreman.



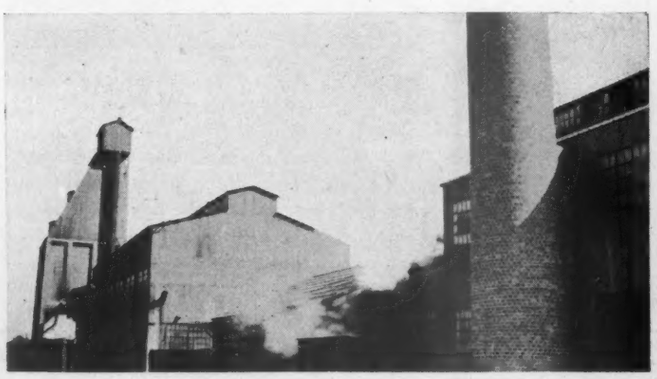
One of the power generating units—Wedron



Control panel in power plant—Wedron

Glencoe Lime Co. New Catalog

A VERY attractive price list and catalog has recently been brought out by the Glencoe Lime and Cement Co. of St. Louis, Mo. The book, which contains 86 pages, is made up in loose-leaf form to permit the addition of new products or price changes at any time. It is exceptionally well illustrated with pictures of actual work under construction, and diagrams of useful information for users of building materials. The portion of the book devoted to the lime produced by the company's four plants contains also considerable information on properties and uses.



Washing plant (background) and power house in the foreground, Wedron Silica Co.

J. A. Dummett (standing) and E. Eick, superintendent and foreman, respectively, Wedron Silica Co.

Practice vs. Possibility in the Cement Manufacturing Industry

Some Random Comments by an Operating Man

By H. H. Blaise
Formerly General Superintendent, Great Western Portland Cement Co.

TO CONSTRUCT THE AVERAGE CEMENT PLANT costs roughly from $1,000 to $2,000 for each barrel of daily production. It often costs one-fourth of the construction figure to operate a plant through the period of a year. These are huge sums, and are amounts that are the constant point of attack by hundreds of engineers, plant officials and executives. It speaks well for the industry that continual progress in design and improvement of operating costs is being made by these men except in isolated cases.

If this were not true the cement industry would be in an exceedingly uncomfortable position today; for mark the fact that while all other industries were forced to increase the price of their commodities during the war and the following period to a very great extent, the cement industry went through the entire period with a comparatively infinitesimal increase. This increase could be covered with ample margin to spare by the inflation in freight rates.

In spite of this we make this prophecy, that those mills which do not look well to their costs sheets and do not search everlastingly for ways and means to secure the utmost in economy will, to a great extent, cease to conduct a profitable business before the present period of strong competition has relaxed. It is further prophesied that there will be a necessity for a reduction in mill-bin costs to the extent of a full one-third within the next decade. Here are presented a very few of the many, many possible "Hows" in that big question of efficiency and cost reduction.

Possible Economies in Quarrying

Quarry operation in the portland cement industry is today for the most part in the hard limestones. Exceptions to these sources of supply are found among the plants using chalk rock in Alabama, the Texas and California oyster-shell mills and those plants using slag, marl and kindred materials. Since by far the larger part of the industry subsists on harder material, that situation alone will be approached here.

To remove limestone from its natural structure, the time-honored method of drill-hole blasting and shovel excavation is the most popular. As yet there seems to be no improvements in sight over this general method. There are, however, numerous refinements which have been developed during the last few years of which advantage may be taken. At present in the average quarry with a rock face running from 15 ft. to 60 ft. in height, well-drill holes from 3 in. to 6 in. in diameter are put down, and these are loaded with standard dynamite in any proportion from 1 lb. of powder to 2½ tons of stone, up to 1 lb. of powder to 5½ tons of stone.

This powder loading is done as a rule by the quarry foreman, or one of his men who gages the amount of powder necessary to secure fragmentation by his "eye" or by his past experience. Seldom if ever is an accurate record kept of conditions. For example, the appearance of a heavier toe from behind a rock blanket may be a signal for heavier loading at this point, while a severe break-back may produce the opposite reaction in the powder man's mind. This method of handling the matter is a crude and costly manner of producing rock fractures, and while the experienced "eye" will always be called upon to do its share, by far the greater dependence should be placed upon methods arrived at by real engineering.

Logging the Shots

Hole sizes, powder placement, stemming, spacing, rate of detonation depth, tonnages and reliable working maps should all enter into the system designed to effect economy and shooting. Systems determining the effect of a shot, such as staking the position of the holes before a shot is fired, in order to afterwards determine the exact extent of the shot, and visual examination, all enter into the scheme of economy. A good system is that of maintaining a large map of the quarry contour. Upon this opposite each shot should be placed all data available in regard to it. Such memoranda after a year or two will be found immensely valuable. Especially will this be so, if the information as to difficult digging and poor production found on the quarry report cards be incorporated into this diagram. At one plant where this was tried with a system of scientific powder loading a reduction of

H. H. Blaise

THE author of this very thought-inspiring article, H. H. Blaise, began his career in the portland cement industry, after being educated as a chemist, with the Lehigh Portland Cement Co. at Mason City, Iowa. Subsequently he went to the Northwestern States Portland Cement Co. as assistant chemist. During the World War he was in the United States Army as a chemist on the manufacture of poison gases. He returned to the portland cement industry as chief chemist of the Gulf States Portland Cement Co. In 1921 he went to the Great Western Portland Cement Co., Kansas City, Mo., and there served progressively as chief chemist and general superintendent in charge of operation and construction. He is now engaged in consulting practice at Mason City, Iowa, specializing in portland cement manufacturing problems. Any discussion which this article may promote will be welcomed by the author and the editor.—The Editor.

42% in the quarry powder cost was attained within the space of 18 months. The ease in handling material, and the increased tonnages resulting therefrom, reduced the rock cost 14 cents per ton, a not inconsiderable item in a mill that already had a reasonably low rock cost.

Some attention should also be given to the use of cheaper explosives. Starch powders costing as much as 3 cents less per pound than nitroglycerine dynamites may be used in dry quarries. Contrary to the general conception, they may also be used in wet holes where the submersion does not exceed four or five hours. The possibility of the use of liquid oxygen as a safe explosive also deserves more consideration than has been given it.

With the railroad type shovel the usual crew required consists of the shovel runner, fireman, four ground men, the powder man and drillers. By the use of tractor wheel shovels, or those with a continuous caterpillar tread, of the complete revolving type, four ground men can be eliminated at once. When gas or electricity is substituted for coal-fired steam-powered shovels still another man can be dispensed with. Gas shovels are not entirely reliable in cold weather, but there are several electric type machines that are not only reliable but very economical.

Transportation of the stone to the mill crushers is now generally accomplished by means of small locomotives and dump cars. The horse and car method still persists as well as aerial tramways, hoists and kindred appliances. With the advent of cheaper power at $0.008 per kw.h., and lower, it is not impossible to visualize the use of centrally controlled, electrical transport systems. By this method one man in a tower can control the movement of electrically-driven automatic dump cars from the quarry to the mill and return. The cars are also automatically dumped from this central control. Thus one man together with the shovel runner and drillers furnish all the man power incident to digging, transporting and crushing the stone into storage. This, of course, would not include the track gang and necessitates the use of feeder machinery at the crusher.

Possible Clay-Pit Economies

The recovery of argillaceous materials is so mixed in character of its requirements, that it is exceedingly difficult to prescribe any standard method of economical recovery. As a rule the cheapest possible situation would be the use of clay or shale overlying the lime deposits in approximately the correct amount for a cement mixture. But when it comes to recovery it is quite evident that what might be cheap for one plant might again be very expensive for another mill.

The use of small electric shovels has its merits, as have dragline attachments on locomotive cranes. One of the most interesting methods is that used at a middle western mill. The clay field at this mill has by a process of evolution during the use of wheeled scrapers always remained a broad and flat working floor. A three-cornered drag carrying heavy pointed teeth was first put over the clay surface. Following this the wheel scrapers traversed the dragged territory and picked up the loosened clay to the average depth of 1 in. This method of shallow widespread gathering resulted in a great deal of sun drying and in an exceedingly even mixture. From this first method this company has gradually developed the use of a gasoline tractor upon which is located the apparatus to tear the clay loose and pick it up; and on the rear of the machine is a short bucket elevator which lifts the clay to the carrying body. This machine dumps the clay into the clay cars spotted beneath a loading chute. The clay gathering at this plant is so scheduled as to have sufficient supply on hand to make it unnecessary to harvest clay during inclement weather.

Author's Explanation

IT IS NOT intended that all things in this discussion be regarded as tried and true methods. There are certain points embodied in this that have stood the test of time, and there are other matters projected here that it is perfectly obvious have not. It is our opinion that the modern cement manufacturer has a tendency to become extremely prosaic and unimaginative.

Perhaps this can be regarded in a small way as a forecast. At any rate this article is offered merely for what it is worth, and the writer in advance announces his positive refusal to accept any brick-bats whatsoever.

We number among our acquaintances a man who, it is said, collects one hundred "wild ideas" from among his subordinates in order to obtain one worth a tryout. This may be an exaggeration, but it is a fact I do know that he encourages the presentation of new ideas, and that he is a highly successful executive.—H. H. Blaise.

Possible Economies in Raw Grinding

Working into the department generally called the raw mill, I can see no real need for a raw-grinding department at all, in the present sense of the word. At least there is certainly no need for a raw mill in excess of one-fifth of the size demanded under present practice. Raw mills at present consume from 4 to 6 kw.h. per barrel of clinker produced in order to reduce limestone from 1-in. size to a material of which 90% will pass through a 200-mesh sieve. It is my opinion that the time will come when not in excess of 2 kw.h. will be used in this department per barrel of production.

With the constant cry for conservation of the heat now wasted in our kilns it has always puzzled me to understand why this heat should not be used to grind the rock. At present (without the use of waste-heat boilers, an addition not always practicable) more than enough heat is wasted in the stack gases between the temperatures of 400 and 1200 deg. F. to drive out the carbon dioxide in any fairly pure limestone. Why the limerock could not be put in contact with this heat, perhaps through an auxiliary rotary shell placed at the feed end of the kiln, or a variation of this method, and come out calcined, at least to the greater degree, is not clear. Certainly the matter is worthy of serious consideration, because once calcined the necessity for large grinding mills in the raw department is eliminated and hydrators using much smaller power requirements are substituted.

The grinding would then be done merely by the addition of sufficient water to hydrate the material to a dry powder. This powder would be finer by many times than any raw mixture ever produced by mechanical means in a cement plant. If small overburned and unground material existed in sufficient quantity it would be a very inexpensive and simple matter to remove it for further grinding by any one of a dozen available methods, say, by passing it over a vibratory screen.

One cement plant is now grinding raw material upon improved ball mills and tube mills and is using an excellent adaptation of the closed circuit. This mill is peculiarly efficient in power consumption, in this department ranging seventh out of 118 mills in the country in the matter of power economy. But where they now require 1180 hp. to reduce the raw material to the proper fineness, it would be difficult to see how they could use more than 300 hp. under the precalcined method.

Perhaps after all this is the answer to the problem that has been occupying so much of the time of some of our master minds and others not so masterly. That is, our search for a "super-cement." Certainly it should be worth something as a saving that would not stop in the raw mill, for we have learned under actual practice that when calcined material is furnished a cement kiln the result is an increase of output amounting to approximately 100%. If this be true we have another $200,000 cut from the construction cost of the kiln department and further saving in operating costs that would run into astonishing figures.

Possible Economies in Kiln Operation

It is true that the average kiln room is even now very economical in the use of man power. In fact it would be difficult to find another department in the mill where more important work is accom-

plished with less help. Sometimes we wonder whether this very economy is not costing us dearly. Since the invention of the rotary cement kiln it has been customary to put the entire control of the kiln upon the judgment of one or two semi-skilled men, who operate purely and simply from the appearance of the kiln interior. As kiln sizes have increased, so have the responsibilities vested in these men.

As a rule the gas analyses, kiln speed and its relation to other kiln conditions, the length of the firing zone, the velocity of the injected fuel and air, the proportion of air to fuel, the amount of fuel being injected within a given time, the actual temperature of the burning zone, the stack temperatures, the stack draft and the analyses of the mixtures being burned mean nothing to these men. It is not their fault, either. While you seldom find an experienced cement man that will not admit that all of these things have a definite and certain relation to one another in the economical and efficient production of a cement clinker, still we have heard chemists, superintendents and plant executives laugh and ridicule the use of really scientific methods in the kiln room. "Gas analysis?" they say, "Oh, we have tried that."

And when they say that, it is at once evident that here is the idea of advancement retarded by the grossest ignorance. How could they have tried it as it should be tried, when an efficient continuous type of flue gas analysis apparatus is yet to be developed!

Educating the Operating Man to His Job

But to get back to the story, I believe for one that the man in charge of the most important single unit in the entire cement plant, namely, the burning equipment, should be educated to his job. He should have the means for determining all of these related things before him in the kiln room next to his work, and for *every minute* that the kiln operates.

Perhaps this man should be a chemical engineer. Accessible to his constant reference he should have automatic CO_2 recorders, stack draft indicators, pyrometers and all of the instruments available for the detection of kiln conditions. Contact with the plant laboratory should be maintained. It is impossible to believe that with the development of such a system much could not be learned about the economy of kiln operation. Certainly an industry that cannot intelligently answer the question of clinker ring formation would not dare to turn thumbs down when real enlightenment is suggested.

Of course, such work will take time and money and lots of real intelligent effort. It will be a job that cannot be worked out overnight and discontinued the next night, but it is a sure thing that real control will come. It must come! Not at those moments when the chemist or the plant superintendent have the leisure or the inclination to make little haphazard tests of grab samples, but every minute of the day or night when the kiln is in operation. There can be no better excuse for burning clinker at temperatures varying from 2150 deg. to 3150 deg. F. than there can be to manufacture steel or rubber tires under conditions varying 35% within the space of one lot of material.

Yet, that is exactly what we are now doing. General practice now is to introduce fuel into the kiln with a deficiency of oxygen required to produce complete combustion. The procurement of the remainder of the air is depended upon by the process of infiltration around the kiln hood or elsewhere. Some 35% of the air required for complete combustion is now considered the maximum safe working point. Here, I wish to go on record with the statement that the only proper amount of air to inject with the fuel is 100%, no more and no less.

Kiln Control

It is to be emphasized further that 100% of air injected with the fuel will, if properly handled, produce a clinker with higher strength qualities, more uniform color, and at least 10% better grindability. It enables the chemist to burn to complete combustion a higher amount of lime with higher resultant strengths in the finished cement. We cannot say definitely whether there is such a thing as a bad or good reaction from reducing and oxidizing flames. It can be said, though, that it is highly probable that there is a difference in the chemical combinations in the clinkers produced by the two methods. A separation of the reduced and oxidized iron in clinkers produced under both methods should show this.

It is certain, however, that a clinker produced with a flame deficient in oxygen or by a flame in which the oxygen has not been properly and thoroughly mixed will when quenched with water turn a sickly shade of yellow, and in many cases disintegrate. Often it is not necessary to quench the clinkers at all to detect the yellow discoloration in the center. If this same clinker be put in an oxidizing flame, the yellow will disappear. If clinkers are produced in a kiln in which a flame generated by 100% air and fuel *properly mixed* has been used, there will be no sign of this yellow discoloration and quenching will not bring it out. The clinker thus produced will have a color that can be relied upon to be as uniform as the raw materials and the character of the fuel.

As to failure of the brick kiln liners, when burning under these conditions, we can definitely say that there need be no more worry from this score than there is when using the usual system of firing *IF*, and mark this well, the conditions of the new fuel mixture be satisfied. What these conditions are will not be discussed here, but they have been worked out fully under actual operating conditions. Failure to accomplish results by the 100% air method are generally charged to "different conditions at our mill" or "that may work some places but not with us." It is hard to understand how conditions can vary enough to warrant the excuse that failure is on account of some mysterious something existing only at that mill.

After all, a rotary kiln is nothing but a hollow burning tube, and cement mixtures are in the main fairly uniform if they are to produce cement, while an oxidizing flame is as fully capable of adjustment as any other flame. The fuel saving is directly proportional to the combustion efficiency curve, a curve that any combustion engineer can depict for you in a jiffy. The truth of the matter is that the successful development of the 100% air method depends upon being fully informed as to the nature of the problem and its benefits. Once ready for the job, success is assured.

Possible Economies in Finish Grinding

The final grinding of portland cement has received much attention recently, and the efficiency of mill machinery is improving by leaps and bounds. There is a tendency, especially since the cost of construction has mounted, to simplify to the utmost. When possible it has become the habit to combine the preliminary grinding with the finishing grinding in one mill or unit.

While some effort has been made to produce closed circuit work on a small scale in relation to these units, we are not aware that any marked success in return of over-size material to the original point of entry has been made. It is a very great question in my mind whether cement clinker as now produced is uniform enough in grinding qualities to permit the use of a unit in which the grinding of the preliminary feed, and the finishing, is done at the same speed and perforce the same feed rate.

For the sake of clarity on this point let us review some actual conditions when grinding was practiced in two steps more exclusively. Take for example a finish mill using kiln run clinkers directly to ball mills of some type. From here they are passed to the tube mills. Under this system, it is not at all unusual to find a time when the clinkers appear to be much more difficult to grind than usual in the ball mills. Sieve analysis of the ball mill output, and feed rates, will show this quickly. On the other hand we may, inside of a few hours, have a change in clinker that will show that the ball mills are again having an easy time of it; and this change may or may not affect the tube mill output. It will be as likely as not that the tube mills are having a very difficult time of it.

We simply offer this as an example of actual grinding conditions and to bring

up the question as to whether a single unit system of compartment mills possesses the flexibility necessary to get 100% production at all times. That is, it would seem that there are times when more work should be delegated to the fine grinders, and other times, in order to get the use of power and machinery expenditures, it would be better to delegate a larger proportion of the work to the preliminary mills.

It is apparent at once that this cannot be done where the preliminary and final grinders are rigidly tied together in one unit, one mill speed with one feed rate. In such a situation a condition reducing the output of either step of production automatically curtails the production of the other. In closed circuit work this is not so.

Closed-Circuit Grinding

There are a few cement mills where the closed circuit system of grinding has been tried—a system by the way that works equally well upon wet material. By this method the fine material is removed at once from the grinding units, and the machine is allowed to work only on that material requiring further reduction. The University of Minnesota prepared several years ago an interesting pamphlet on this subject showing that the greater the speed the material was passed through the circuit, and the greater the volume of feed in proportion to the final production, the more efficient the grinding.

In these experiments, which were carried on with typical machinery, they carried the feed up 600% of the final production, and were still obtaining an increase in output. This is perhaps working into extraordinary figures, for in ordinary operation the cost of conveying would mount up to excessive sums. But the writer has personally tried this order of procedure using up to 200% material in the circuit, and has had very successful results. On a 7-ft. tube mill producing 95 bbl. an hour on the ordinary open-circuit the production was increased to 137 bbl. per hour. The test was made on 400.000 bbl. of clinker taken from the kilns and also from outside storage. The extra power required to produce this increase of 42 bbl. an hour consisted of about 6 hp. The investment about $6,000.

I know of no other method by which more cement can be produced with as small an outlay. There is no questioning the fact that a correct adaptation of the closed circuit grinding will produce cement from clinkers with an expenditure of 3.5 kw.h. per barrel. This much has been done on layouts not particularly conducive to economy, and this figure could probably be maintained easily on a department designed specifically for this purpose. Of course, under this system the initial expenditure for construction would be a little higher than under the single-unit method, but some attention should be paid to operating costs during the layout.

There are too many companies erecting plants at low constructive costs only to find that it requires an excessive amount of power to operate the mill, and, further, that there are times when production is seriously hampered. There are too many mills requiring from 15 to 18 kw.h. to produce a barrel of cement; and we have on record new mills that require 26 kw.h. to accomplish this result. Of course, it is a well-known fact that simple construction and duplication of machine parts spells smaller replacement lists and an easier time for the repair gang; but it is extremely possible that some of us have bent backwards in an effort to build a cement plant in a silk hat with a Mexican dollar. At any rate we are all looking for a happy medium, and it's a canny manufacturer indeed who is not guilty of at least an error some time in his career.

Some Things We Don't Know About Cement*

By PROF. HANS KUEHL

THE 50th anniversary of the founding of the German Portland Cement Manufacturers Association, though not celebrated elaborately, has without doubt brought to mind to many a cement chemist the outstanding services rendered by the association regarding scientific aspects of cement problems, and perhaps has caused him to reflect seriously on the important future research on cement which must be undertaken.

I have in the past on many other occasions tried to point out future activities of cement research. In view of the amount of literature, referring today to the past activities, an attempt will be made here to avoid recapitulation. Nevertheless, it must be emphasized at this point that the subject of hydraulic cementing materials and cement proper presents many a puzzle awaiting solution, and that some of the most trivial problems in this connection, dealt with every day until they cease to arrest our attention, are still lacking scientific explanation. The following list is the result of an arbitrary selection of topics encountered day by day. Many readers may be prepared to answer some of the questions which appear quite superfluous on this list. Yet the author is of the opinion that none of the 50 questions below has received satisfactory scientific explanation and that the simplest questions are just the ones which require considerable meditation, provided they are not treated in a superficial manner. I am limiting myself at this time to the enumeration of the questions, adding no comments, as quite a few of the points are the subject of much discussion at the present time.

How many of the questions given herewith can you answer in a way deemed to be correct within our present knowledge?

1. Why is underburned clinker of a straw-yellow color?
2. How do you account for the better hardening properties of the sintered product inasmuch as the clay or shale are already completely decomposed in underburned clinker?
3. What is the extent of the reaction of lime with constituents of the shale before sintering is reached?
4. What is the origin of the greenish-black color of portland cement clinker, as iron oxide compounds are otherwise brown?
5. Why does an admixture of a few per cent fluorspar change the color of portland cement to violet or violet brown?
6. Why are there no cements with barium or strontium base, as these elements are closely similar to calcium?
7. Why is the transmission of heat imperfect even in the longest rotary kilns?
8. How should the structure of tricalcium silicate be represented?
9. What is alite?
10. Why do calcium silicates require much lime and calcium aluminates little lime for good hardening?
11. What is the reason for the difference in the hardening properties of calcium aluminates and calcium ferrites?
12. Why does the manganese oxide content impair the activity of blast furnace slag?
13. Why is magnesia, detrimental in portland cement, harmless in blast furnace slag?
14. Why do basic slags, which are already alkaline, require alkaline accelerators?
15. On what theory is based the accelerating action of high gypsum admixtures on glassy slags?
16. Why do crystalline slags react more readily with carbon dioxide than glassy slags, despite their low potential energy?
17. Why are test pats made of blast furnace slags and potassium base which have a high strength, so easily friable?
18. Why is fused cement almost gray or brown, but never of the color of portland cement?
19. In what form are the secondary constituents present in fused cement?
20. Why does the tensile strength of fused cement lag?
21. Why do combinations of portland cement and fused cement give poor results?
22. Is it the activity of cement in the presence of water or the rate of congealing of the new compounds produced that determines the setting of cement? Why?
23. Why does addition of water to clinker retard the time of set of cement?
24. What is the cause of the grey color of hardened cement?
25. What is the composition of the lime hydrosilicate gel?
26. How do you explain the action of catalyzers on the time of set?
27. Why do caustic and carbonaceous alkalis accelerate the set of all cements?
28. Why does a small quantity of sugar

*Zement (1927), 11, 200-201.

retard the set and initial hardening of portland cement?

29. Why do calcium chloride solutions of different concentration accelerate or retard setting?

30. What is the reason for the abrupt change of time of set which takes place at a certain fineness of portland cement?

31. How do you account for the abrupt change of time of set which certain increasing gypsum admixtures give to portland cement which is quick-setting?

32. Why is the retarding action of gypsum more pronounced when gypsum is ground with portland cement than when it is added subsequently?

33. Is it the activity of cement in the presence of water or the rate of congealing of the new compounds produced that determines the rate of hardening of cement?

34. What is the cause of mixtures of cement and sand, pressed dry and subsequently sprinkled with water, to show no set or an unsatisfactory set?

35. Why do gypsum and calcium chloride admixtures increase the strength of cement?

36. Why do even small quantities of alkalis reduce the strength?

37. Why do quick-setting cements in spite of their high activity almost invariably have low strength properties?

38. What is the reason for the irregular trend of strength curves of even good cements? Why is it impossible to establish parallel relations between water and air curing and between tensile and compressive strength?

39. Explain unsoundness phenomena on the basis that all hydration processes take place with contraction of the mortar?

40. What are the chemical causes of unsoundness produced by magnesia?

41. How do you explain that slight increases in the lime content of portland cement lead from highest strengths to unsoundness?

42. Why do pats of unsound cements warp either upwards or downwards?

43. Why does insufficient burning produce unsoundness?

44. Why do all soundness tests yield different results?

45. What are the forces which lead to cracking of pats of practically sound cements?

46. How should unsoundness in air be explained in cements sound in water?

47. On what is based the belief that additions of gypsum or calcium chloride are beneficial to test specimens which are to be boiled?

48. Why can portland cements showing unsoundness due to gypsum be rectified by admixtures of slag contrary to cements unsound due to lime?

49. What are the reasons for lower strength on the inside of large concrete bodies than on the outside?

50. Why do bituminous admixtures in cement make mortar and concrete watertight?

The author believes that his readers can have no doubt as to whether cement research will soon run out of material for investigation. Yet the questions were limited to mortars known today, while there is the possibility that new cements will be looked for and found in the future and will lead to corresponding studies.

European Methods of Potash Mining May Be Applied in United States

THE SEARCH for commercial potash supplies now being conducted by the federal government in western Texas and eastern New Mexico has led to the preparation of a report by the United States Bureau of Mines, Department of Commerce, on the methods and costs of potash mining in Germany and France. Consideration has been given to the possible application of similar methods when mining of the American potash deposits is undertaken.

Nearly 95% of the present world production of commercial potash is derived from the soluble potash-salt deposits of Germany and France, state George S. Rice and John A. Davis in the Bureau of Mines report. The estimates of German potash reserves vary from 22,000,000,000 to 3,840,000,000,000 short tons of crude salts. The French reserves are estimated at approximately 1,600,000,000 short tons. The recently discovered deep deposits in Texas and New Mexico are believed by competent geologists and engineers to contain many millions of tons of soluble potash-salts. They are being extensively prospected by drilling, with a view to developing a source of supply which, with potash derived from Searles Lake and other sources of brine, should render the United States less dependent upon the present Franco-German monopoly.

The geological structure makes the depth of the German potash beds extremely variable, ranging from 665 ft. to 3950 ft., or even greater in some of the synclines. However, most of the mining is done at depths of 1300 to 1950 ft. The depths of the Alsatian potash mines range from 1625 ft. at the southwestern to 2850 ft. at the northeastern end of the field. The thickness of the potash deposits in Germany is varied, ranging all the way from 6 to 165 ft. thick. The French deposits are much more uniform. There are two beds throughout most of the productive area, the upper being 2½ to 5½ and the lower 6½ to 17½ ft. thick.

Prospecting for potash deposits in both Germany and France is necessarily done by deep drilling. Churn drills are frequently used in penetrating the overlying sediments, but rotary core drills are always employed in drilling through the potash salts, with $MgCl_2$ solution as a washing medium.

The shafts are invariably perpendicular, with a circular cross section and diameters of 13 to 19½ ft. Ordinary hand methods are used in sinking through dry strata, but various methods, including the drop-shaft. freezing, Kind-Chaudron, and cementation processes, are employed in penetrating water-bearing sands and gravels, which usually occur above the potash deposits. The shafts are lined with brick or concrete when the inclosing rocks are dry and with cast-iron tubbing through water-bearing zones.

In steeply dipping deposits the potash salt is mined by overhand chamber-stoping protected by pillars and followed by back filling with waste rock obtained from separate stopes excavated in the footwall strata. The methods employed in more nearly horizontal deposits resemble those of coal mining.

Drilling is usually done with electric rotary drills when a heading or an advancing face is driven, but hand drills are commonly employed in stoping. Blasting is done chiefly with ammonia powder, but black powder is sometimes used in the German stopes. The broken salts are generally hauled to the shaft by electric trolley locomotives. Both electrically driven and steam driven hoists are used to bring the salts to the surface in the mine cars. The high temperatures of the rock strata in the potash mines and the occurrence of inflammable gases, particularly in Alsace, necessitate mechanical ventilation moving relatively large quantities of air Open-flame lamps are still employed in the German mines, but safety or portable electric lamps are required in France. Remarkably little timber is used, as the main levels are often lined with brick or concrete and the stopes are promptly back filled with waste rock salt or other waste.

The crude salts, as they come from the mine, are crushed and either sold directly for fertilizer or treated chemically to remove impurities and increase the potash content of the product. The refining process consists essentially of lixiviation, usually in hot solutions, then cooling and crystallization.

The average cost of producing a unit of K_2O (20 lb. per short ton of product) during 1926 in Germany is estimated to have been approximately 30¼ cents. The estimated cost during the same year in France was about 9.6 cents. The lower French cost is due in part to the higher potash content of the crude salts as mined, in part to the simpler refining process which could be used in the absence of magnesium compounds in the salts being treated, in part to the fact that the Alsatian industry was not burdened by "closed-down" mines, and in large part to depreciation of the French franc.

The selling prices on the American markets include inland freight in Germany or France, ocean freight to American Atlantic or Gulf ports, marketing cost, quota charges in the case of Germany or income taxes in the case of France, and profits. The total in 1926 ranged from 72.5 cents per unit of K_2O for low-grade raw salts to 95 cents per unit for potassium sulphate.

Copies of Bureau of Mines Bulletin 274, "Potash Mining in Germany and France," may be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C., at a price of 25 cents.

Lime Burning Practice Based on European and American Observations

Part II.—Heat Distribution in Lime Kilns, Gas Flow, Lime Flow; Causes of Irregular Flow

By Victor J. Azbe
Consulting Engineer, St. Louis, Mo.

IN A LIME PLANT where the most exact supervision is given the combustion process, where heat radiation, excess air loss and incomplete combustion losses are reduced to the practical minimum, results obtained from kilns, their thermal efficiency, may still be poor. Heat will go into the kilns in available form, but for some reason this heat will get wasted through the kiln and most of it will not be utilized to make lime.

For a kiln to be most efficient, it is necessary, in addition to having good combustion with little excess air, that the gas flow through the kiln cross-section be uniform. Fig. 3 shows what occurs in most kilns. The boundaries between lime burned to the same degree are not level. The temperatures across the kiln on one level are not the same. It is possible to have on one level over-burned lime, properly burned lime and lime with considerable core. Now while drawing the over-burned and completely burned lime should be removed, and lime with core should remain in the kiln. Ordinarily, however, to do this is possible only to a limited degree, and much good lime ordinarily remains in the kiln above the kiln eyes. Kilns have been observed drawing core from the center, when lime extended half way up the kiln, but could not be gotten out.

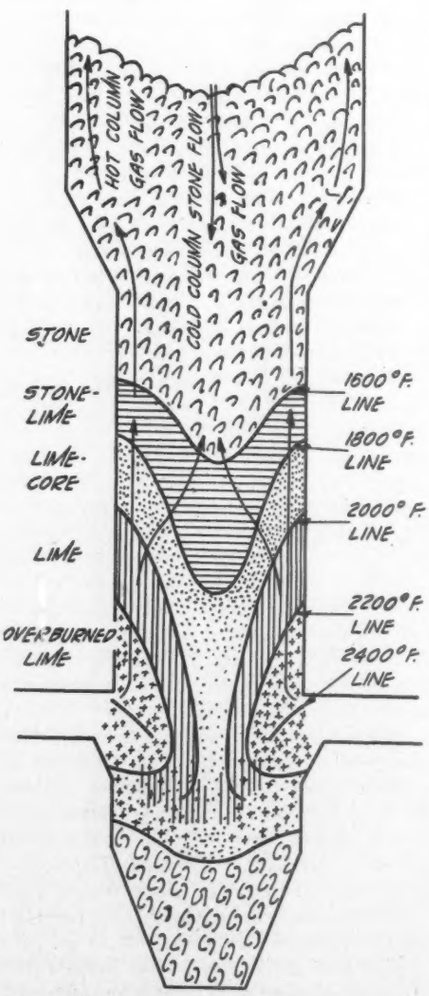


Fig. 3. Diagram illustrating zones of equal temperature and of degree to which lime is burned in a conventional lime kiln

Editor's Note

THIS is the second of a series of articles announced in ROCK PRODUCTS, January 7. The first article on varieties of limestone and a comparison of kiln types appeared in the January 21 issue.—The Editor.

As anyone should know, the hotter a chimney or any column of gas, the stronger will be the draft. In a lime kiln those sections that are the hottest draw the strongest and get the most heat. It is in these columns that lime may be completely burned as high at times as 20 ft. up into the kiln. On the other hand, those sections where lime still contains the core, which tends to cool the lump, are comparatively low in temperature and so draw poorly and consequently get less gas. This situation is most unfortunate. Where the least heat is obtained, the most is needed and vice versa; where the lime is already completely burned or over-burned the most heat is supplied.

After once such conditions are created in a kiln they are most difficult to correct. The only way really to correct them is to draw the burned lime out of the kiln and so destroy the overly hot column, but that ordinarily is impossible because lime with core would come along with it. To make the situation particularly bad, the lime with core from cool kiln portions tends to travel faster than the completely burned lime from the hot portions of the kiln.

Method of Checking Gas Flow Uniformity

To definitely check the unequal gas flow, the writer, on a certain direct-fired kiln, tried out a novel test method. First, the kiln cubical content and the free space was calculated, and it was found that at the rate at which the kiln was being operated gas should have required 28 seconds to pass from the furnace through the kiln to the outlet. By explosion of magnesium flashlight powders in the furnace, which powder gives an extremely fine dust that is not affected by kiln temperatures and flows with the gas, it was found that some of the gas passed through the kiln in only 10 seconds and other parts of it required 35 seconds. Some portions of the gas got through the kiln over three times as fast as others, while all left the furnace at identically the same time. This test nicely demonstrates that the kiln contained a hot column, above spoken of, through which the gas passed at a very high velocity. Also, the kiln contained comparatively quiet zones in which other portions of the gas got lost. Naturally, in these quiet zones lime was made at a rather slow rate.

If this is not so, how is it possible to obtain hard burned lime and lime with core in the same draw? The kiln contains what is practically a chimney, that may actually draw gas away from the cooler zones and cause recirculation; that is, downward flow of gas, ridiculous as this may sound.

Proper flow of gas should be such that successive horizontal layers would all be at the same temperature. One layer would be completely burned, lime ready to draw, the next layer containing a given amount of core, the next more core, and so on until the line would be reached where below, the limestone surface would just be beginning to burn to lime, and above, where the limestone surface would be just finished preheating. We would thus have uniform composition on these layers, uniform temperature and as a consequence uniform gas flow. This, however, is an ideal that can never be fully approached, not even by the very best kilns.

Most frequently the situation as shown by

Fig. 3 exists, and due to unequal composition there is unequal temperature, which results in unequal gas flow. A certain distance up in the kiln the hot gas containing heat that could well make lime, whips over into the cool zones and the heat is wasted in preheating of the stone. To fully appreciate this, we must remember that heat in the gas is of two kinds, of high elevation above 1600 deg. F., that should only be used to decompose limestone, and that of low elevation usable only for preheating limestone. Since there is more heat of low elevation than is necessary for preheating the limestone, the use of any heat of high elevation for this purpose is a distinct loss. This is the very thing that happens in most kilns, and it is this thing that is responsible for some plants not being able to get more than 3½ to 1 ratio, no matter what they do nor how carefully the kilns are fired.

Irregular Gas Flow and Lime Quality

But kiln efficiency is not the only thing that is harmfully affected; kiln capacity, lime quality and kiln life, the four not usually connected together, are all more or less dependent upon the very same influence of "irregular flow of gas through the kiln cross section." Any irregularity of flow will immediately cause the burning of some pieces of lime harder than others, some may be over-burned and others under-burned; the CaO content may be low even though there may not be any core, or only a little core; such characteristics as plasticity, solubility, availability, rate of settling, slaking rate, etc., will have no uniformity in the various lumps of lime from a single draw. It will tend to reduce kiln capacity because certain kiln zones will be inactive and the gas flow will be sluggish; that is, little heat available to work on the stones while in other zones there will be an excess of gas flow, plenty of heat, but no undecomposed stone for the heat to work on. Then, naturally, if a lump of lime that is completely burned lays up against the kiln wall with a high temperature flame working on it for hours, a chemical combination will occur between it and the brick; and as soon as this happens the brick is not any more a brick, it is slag of rather low fusing temperature, and will either run, or be rubbed off easily by the lime sliding by. If the gas flow were uniform, the highest temperatures would not extend up as high into the kiln, and lime not far above the eye, up against the wall, would contain the cooling core, thus preventing excessive temperatures; the heat would not be so concentrated, and so the kiln lining's life would be much longer.

Causes of Irregular Gas Flow

Irregular gas flow may be caused by many different influences. Some of them are:

(1) For the gas after it enters the kiln to flow upwards is much more natural than to penetrate 2 or 3 ft. to the kiln center. Due to this the lime is made more rapidly above kiln eyes, which causes zones of high temperatures and of higher draft. As soon as this occurs the gas tendency to flow up the side walls increases, which again results in higher temperature and higher draft. This action is cumulative until something occurs to stop its further increase.

(2) Improper trimming of the kiln has much to do with unequal gas flow. The idea is, of course, to get the lime out where

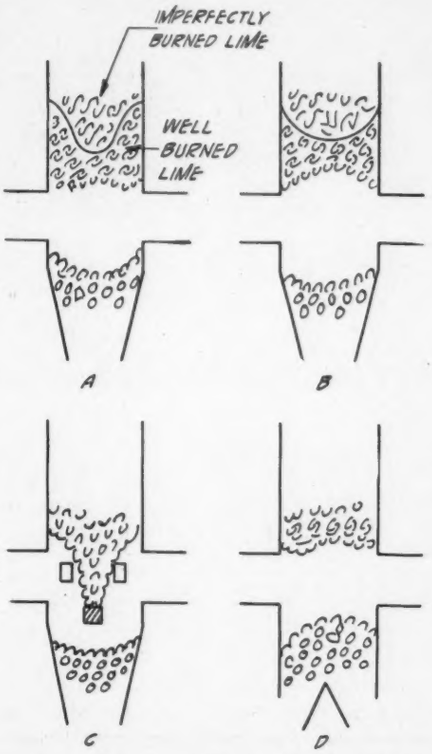


Fig. 4. Illustrating the effects of different ways of drawing the kiln on the gas flow

the lime is; that is, out of these chimneys, the zones of strong draft; but that is only imperfectly possible. To rightly trim the kiln is almost impossible. It can only be approximated. The lime burner can often increase the output of a small kiln several tons of lime per day by trimming it in a careful manner. The idea of course being to get more lime out of zones where it tends to burn high.

(3) The method of drawing has much to do with equal gas flow. *A* of Fig. 4 shows that in an ordinary kiln, lime in the cooler assumes a convex position, and after trimming, when the slip occurs, the tendency always is for the center to fall farther, and in addition faster than the sides. Due to this, the boundary line between perfectly and imperfectly burned lime never assumes the desired horizontal position, and so conditions of gas flow remain upset. *B* shows about the same condition, only worse, due to convex trimming. *C* shows an effort at improvement of the situation by installation of an arch pier that tends to hold the weak center back, and gives opportunity to properly trim the eyes. *D* is still another effort. The lime is drawn from immediately below the eyes of the kiln when the weak center does not have to fall so far.

All of these conditions are more or less imperfect, the flow of lime through the kiln being erratic and difficult to analyze. The matter will be again discussed when specific methods of drawing used in Europe will be described. It may be mentioned here that nowhere in Germany or England a plant could be found where the lime was allowed to stick when drawing. They all operate so that there is a slip without any trimming; and apparently more satisfactory results are obtained than when sticking the kiln as we do in this country.

(To be continued.)

Investigation of Feldspar Characteristics

A NUMBER of the characteristics of different feldspars were investigated at the Bureau of Standards and reported in *Technical News Bulletins* No. 117 and No. 121. The work is being continued by a study of the effect of feldspar upon the thermal expansion of vitreous and "semi-vitreous" bodies containing feldspars of varying alkali content ranging from high soda to high potash feldspar.

Thermal expansion observations were made by the interferometer method, using triangular specimens hand pressed in plaster molds and fired according to the firing schedule on page 11 of *Technical News Bulletin* No. 121. Two sections of "semivitreous" bodies fired to cone 8 were made for comparison, using two different formulas, one developed by the bureau and the other suggested by the white-ware advisory committee. The data indicate:

1. A very noticeable increase in rate of expansion in the range 560 to 600 deg. C. for specimens of all firings.

2. All bodies containing the high potash feldspar show the smallest percentage of expansion at 700 deg. C. for all of the different rates of firing and cooling used. The expansion appears to increase in Na_2O content of the feldspar, the relation being affected however, by the uncombined silica content.

Additional observations were made using two "semivitreous" bodies containing the highest soda and highest potash feldspars, respectively, fired to cones, 4, 6, 8, and 10. The tests were made to determine the effect of increasing heat treatment upon the expansion. The data obtained, using the high soda feldspar, showing the expansion to be practically the same for specimens fired to cones 4 to 6 and 8, but with those fired to cone 10 the expansion is appreciably lower (about 0.03 per cent). The expansion for the high potash bodies is highest when fired to cone 4 and lowest when fired to cones 8 and 10, with a difference of about 0.04 per cent.—*Technical News Bulletin.*

Mountains of waste surround the quarries

Modern plant of the Colonial Slate Co., Wind Gap, Penn.

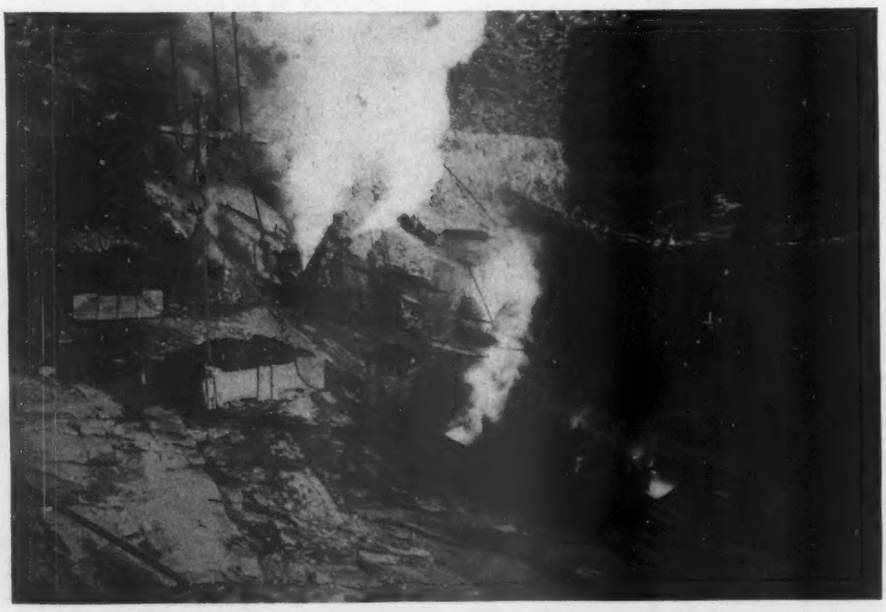
Quarrying and Manufacture of Slate

Colonial Slate Co.'s Mill at Wind Gap, Penn., a Fine Example of What Can Be Done to Modernize Manufacture of Slate Products

By J. R. Thoenen

Mining Engineer, U. S. Bureau of Mines, Non-Metallic Minerals Experiment Station, New Brunswick, N. J.

THE QUARRYING and manufacture of slate is one of the older of the rock products industries in the United States. Like many others, it has tenaciously held fast to many long established customs of recovery and manufacture. The peculiar characteristics of origin and composition of slate have fostered certain time honored customs of quarry operation differing greatly from those minerals of other stone products. This together with the comparatively localized area of production has built up a personnel, intent on supplying market demands for the product to the exclusion of much thought in possible improvement of methods and extension of markets. However, in spite of this, great progress has been made, especially during the past five years.



View in the quarry showing the channeling machine at work

Competition Forces Progress

Of recent years, owing to the inroads of other competitive products, operators have been forced to take stock of the situation and give more and more study to the future. As a result new methods of quarry practice and new markets have been found, till the industry as a whole is now beginning to enjoy a new picture of future possibilities.

Originally quarried for school slates, roofing slates and blackboards, slate has branched out into many uses such as electrical switchboards, and interior structural materials where strength and sanitation are requisite. Also countless and varied small articles such as table tops, electric lamp bases, moldings, etc., are now being made both in natural color and artistically decorated. Wastes are also being ground and manufactured as fillers for various uses. This progress in the technology of slate has been made possible only after a study (as yet in its infancy) of the peculiar qualities and adaptability of the material itself.

One cannot but be impressed after a short trip through the producing districts by the immense former and present waste in the industry. Veritable mountains of waste product are the inevitable and ever-present indicator of the near presence of a slate quarry. This waste comes from two sources, the quarry and the mill. Of the total material taken from the quarries, only 10 to 15% finds its way to commercial markets. A

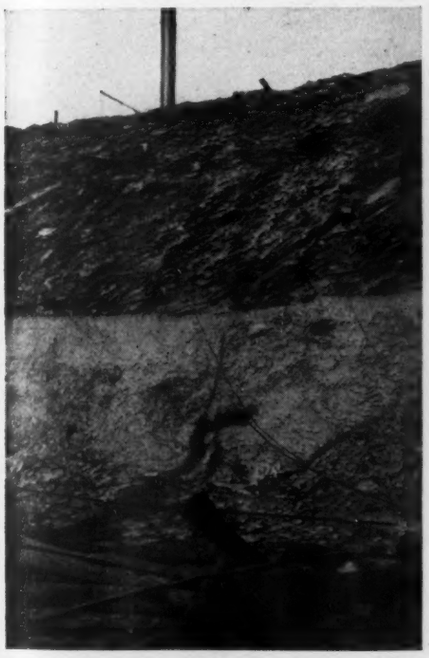
Splitting slate from the solid—"raising the split"

Splitting the blocks to handling size

little calculation will show that with this percentage of discard the present quarry holes could be filled with waste material and there would still be large accumulations left over. One wonders what other rock products industry could stand such concentration and still live.

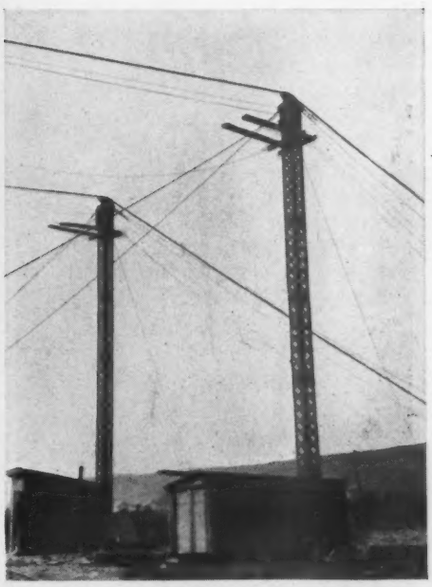
Slate is a combination of minerals rather than a distinct species, a product of metamorphism subsequent to deposition. Originally deposited by slow precipitation or settling of exceedingly finely subdivided materials such as clays, micas, carbonates of lime, magnesium, and iron, and various silicates, it was later subjected to enormous pressure. This pressure probably came from further submergence and the deposition from above of many thousands of feet of other rocks. It had the effect of consolidating this finely divided precipitate into shales varying in composition with the minerals deposited.

That this original pressure was exceedingly uniform and devoid of any lateral agency is evidenced by the remarkable continuity and uniformity of even very thin beds or "ribbons" extending for miles in the so-called slate "veins." These are so extensive

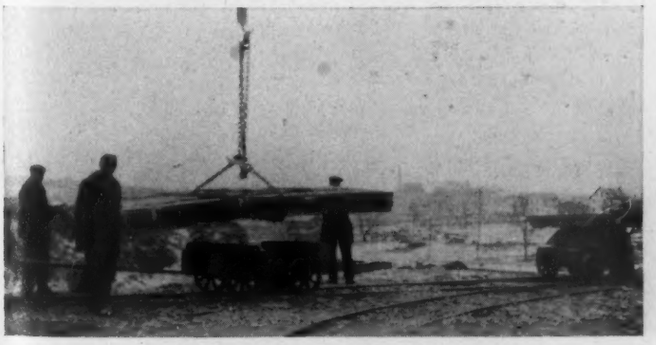


Overburden and waste stripped from quarry opening

Starting the block to the mill



Overhead cableway supported from steel towers



Loading the slab on the mill trucks

Gasoline locomotive hauling slabs to the mill

Interior view of the mill room

Splitting the block to structural thickness

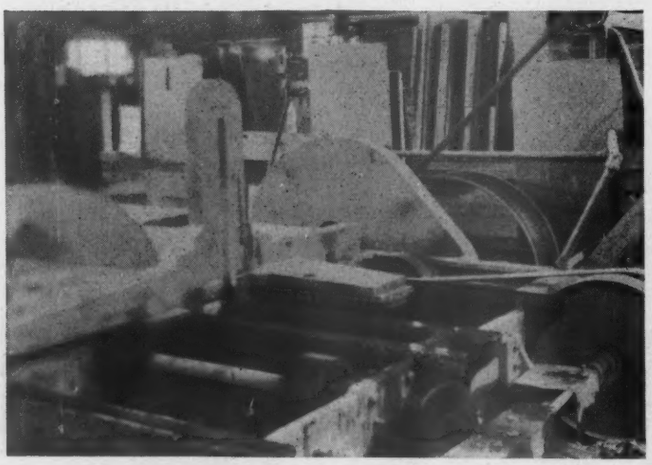
and well defined that the early operators gave them various names and so recognized them in various quarries.

Subsequent to the formation of the shales the material was apparently subjected to intense lateral as well as vertical pressures accompanied by high temperatures. This combination caused the original minerals of the shales to recrystallize into new metamorphic products or minerals. It even went further and caused these new crystals to form with their long axes parallel and roughly perpendicular to the source of pressure. This has resulted in the perfect cleavage or "split" peculiar to slate.

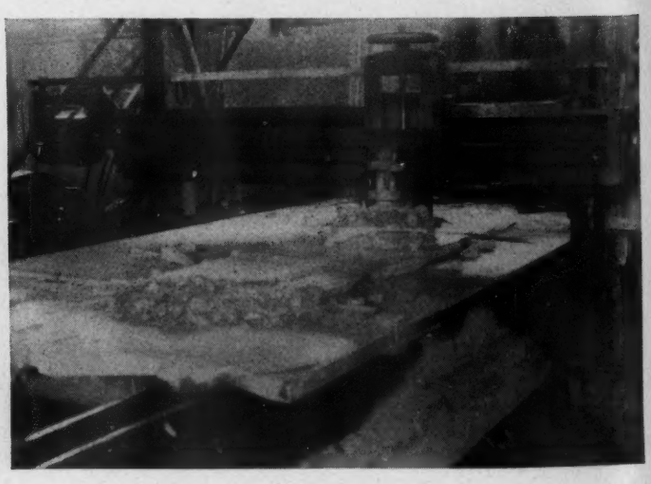
Later, intense but slow acting pressures caused bending and folding of the beds into many fantastic shapes. Some now stand vertical or nearly so, while others still retain their original horizontal position.

While slates are found in many parts of the country, few deposits have been commercially worked outside of those in Pennsylvania, Vermont, New York, Maine and Virginia. Consequently slate has not found as wide a market as might have been possible if development were over a wider area.

Saw table in operation showing (left) the saw entering and (right) leaving the block



Individual motor drive of the saw table



Planing the block to exact size

A Modern Slate Mill

The Colonial Slate Co., owned and operated by the Spry brothers, Sidney and William, is typical of the more modern thought in both quarry operation and fabrication methods. Situated at the edge of the town of Wind Gap in eastern Northampton county, Penn., this quarry lies on the Albion Run of the soft vein slates. These are probably of higher carbonate content in contrast to the hard vein slate. The physical arrangement of the component mineral crystals is also contributory to the differing hardness. This softer character permits easier handling in the mill and better adapts the product to various cutting and forming operations.

Beginning at the quarry, the operation in general is typical of the customary procedure. Slate blocks are split from the solid and hoisted on overhead cableways to a landing on the surface.

Advanced Quarrying Methods

Illustrative of the advance in quarry methods, slate was originally blasted by drilling holes by hand or air drill parallel to the "grain" (in this quarry roughly perpendicular to both bedding and split) and shooting them with black powder. This procedure, called "scalloping," was productive of great waste, in that blasting shattered the slate for several feet from the hole in all directions, rendering it useless as commercial material.

The next step was to introduce channeling machines which cut the slate loose from the walls or "backs," as they are locally called. The quarry floor was then cut into convenient blocks by transverse cuts with the channelers. This greatly reduced the quarry waste from blasting, but powder was not even then entirely eliminated.

After completing the channeler cuts the slate was lifted on the "split" by means of chisels and wedges driven into the block by hand hammers. Once split loose from the solid the blocks were broken to convenient size for handling by drilling holes in rows along the grain and cracked by plug and feather or shooting with black powder.

By this method it was found that while the waste from scallop blasting was reduced there still was considerable shattering on either side of the channel cuts. These varied with the quarry from 6 in. to a maximum of 4 ft. on either side.

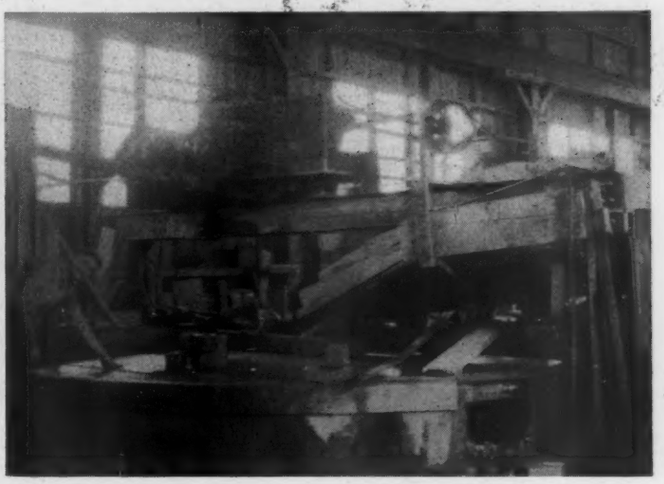
Recently the search for better methods has resulted in pioneer experimentation—instigated by Dr. Oliver Bowles, superintendent of the Non-metallic Station of the Bureau of Mines at New Brunswick, N. J., and carried out with the co-operation of the National Slate Association at the quarry of the Colonial Slate Co.—in the use of a wire saw in place of the channelers. These experiments have been entirely successful in this quarry and have resulted in almost entire elimination of the channelers.

Preliminary description of the wire saw operation has been published as Bureau of Mines, Reports of Investigations, Serial No. 2820, July, 1927, by Dr. Bowles (Rock Products, August 20, 1927), and will shortly be followed by a later concluding report.

Modern practice at this quarry is further evidenced by the steel cableway towers using a three-cable lifting rope in place of the old wooden towers and dangerous single rope.

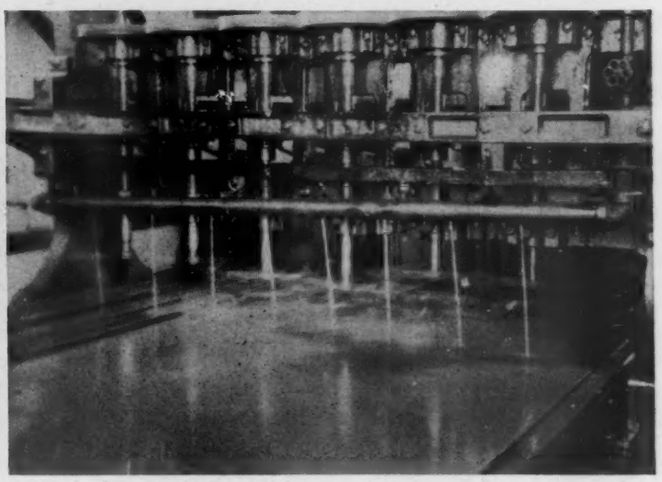
When the quarry blocks are once brought

Handling blocks by overhead crane

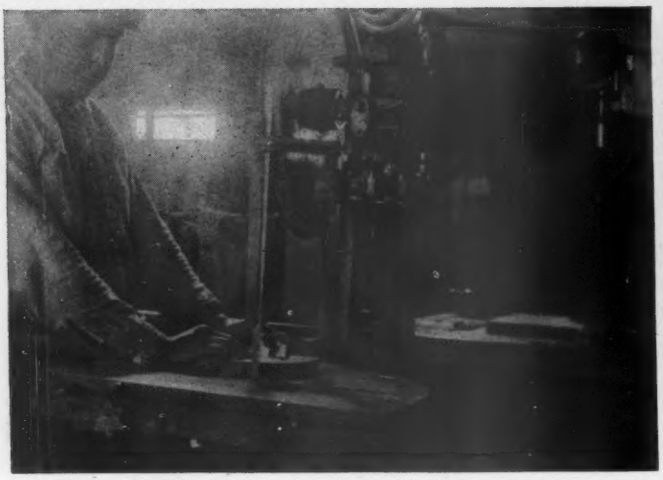


Rubbing bed for blackboard slate

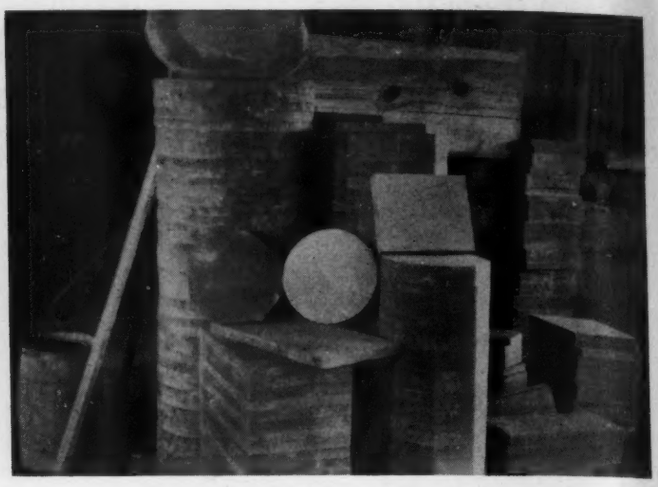
Rubbing structural slate



Buffing machine for polishing blockboards



Cutting curved shaped on bandsaw table



Some of the irregular material made

to the surface they are landed on wooden car trucks and hauled to the mill by gasoline locomotives. Entering the mill, the blocks are inspected by the mill foreman and marked for structural or blackboard material according to size and quality and then stacked in piles by a 10-ton overhead electrical crane until the saws are ready for them.

Cutting

These blocks are very irregular in size and shape and require cutting to such sizes as stock requirements necessitate. This is done by placing the blocks on large flat perforated iron saw beds which are moved slowly forward and the block pressed against a revolving circle saw similar to those used in woodworking mills, except that they are thicker and have much larger teeth. The saws revolve quite slowly and cut the stone dry. Saw tables are driven by individual electric motors, thereby eliminating overhead drive shafts and belting which would interfere with the crane operation.

When squared to approximate size the blocks are split to the required thickness, varying in structural material from ½-in. to several inches and in blackboards from ⅜- to ½-in. The split blocks are next sent to the rubbing beds or the planer.

Sizing

Structural material requiring exact sizing goes to the planer, which closely resembles its namesake of the machine shop. The material is fastened to a movable bed and fed under the knife or plane. The plane or cutter is supported on a rigid transverse frame and is manipulated both horizontally and vertically by screw and hand wheel from the side of the bed.

After planing, this material is next sent to the cutting tables for exact sizing by carborundum wheel cutters. By means of various shaped wheels many shapes and forms are made from the original stock.

Surfacing

Blackboards and finished structural material are next sent to the rubbing beds for surfacing and polishing. These are huge circular cast iron discs revolving around a central spindle. The boards or blocks are placed on the beds first on edge for jointing and then flat for surfacing. As the bed revolves under them they are held in place against a stationary beam extending across the bed and heavy cast iron weights are used to press the boards down onto the bed. Sand and water fed from V-shaped sand boxes above the bed furnish the abrasive materials and effectively smooths and polishes the surface and edges of the blocks.

Polishing

These rubbing beds do not give the high polish required for modern blackboards, so they are next sent to the polishing machine or buffer. This machine has been developed to replace the former tedious and slow hand operation. As can be seen from the illustration, it consists of a movable bed carrying the boards back and forth under revolving carborundum blocks. These blocks revolve at a moderate rate of speed (80 r.p.m.), each in reverse direction to that next to it. Also each block is synchronized to move over area covered by that adjacent, so that the entire surface is completely covered many times. Clean water is used as a lubricant in this process.

From here the blackboards are sent to the storage racks, where they are sorted and

Drilling holes with a drill press

Hand splitting shingles

stocked in sizes, a few of which can be seen in the illustration.

Sawing Special Shapes

Circles and ovals as well as irregular curved edges are cut on an ordinary band saw table in the same manner that wood is worked, except that special saws are required. Here again no lubricant is used and the saw cuts dry. Curved surfaces of structural shapes are smoothed by hand. Irregular structural shapes such as sink drain boards, electric panels, etc., are cut and bored by air-actuated chipping tools and drill presses.

Decorative Slate Slabs

In some of the mills slate slabs for interior construction are subjected to further treatment to satisfy a demand for decorative architecture. The ability of slate to take and hold a paint surface is utilized by spraying with "Duco" and other pigments to either a plain or mottled or splotched finish which is finding more and more favor among those who object to the drab appearance of the natural slate. One operator in the Pennsylvania field has gone even further and by means of a printing process has introduced an imitation marble finish of very attractive appearance.

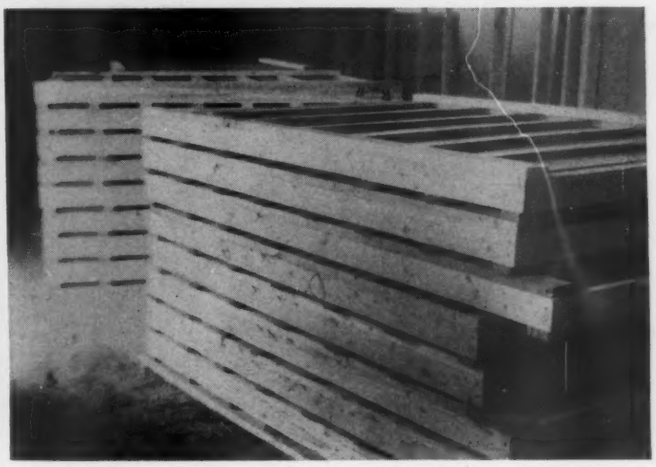
The grinding of heretofore waste material into fillers is a recent departure indicative of many future possibilities. This ground material has found favor as a filler for such varied outlets as paint, paper and asphalt.

Roofing Slate

Irregular blocks from the quarry otherwise unsuited for blackboards and structural shapes are sent to the "shanties" for splitting into roofing slate. Here original methods are still in vogue in this as well as in most slate mills. The slater by means of an air drill and plug and feathers cuts the blocks as delivered to him to convenient size. He then splits them into suitable thicknesses for shingles by means of long, thin steel chisels or splitting tools and wooden mallets. Splitting is an acquired art jealously guarded by slaters and handed down from generation to generation. After splitting, the irregular shapes are trimmed to size by long, foot-operated knives or shears. The slate is laid on the stationary iron blade and the movable blade brought forcibly across it by means of a treadle.

At one Pennsylvania mill even this ancient operation has been superseded by mechanically operated revolving shears, cylindrical in shape, with a spiral cutting edge. In this mill waste material drops to a modern belt conveyor and is thus carried to the waste pile.

The disuse of school slates has relegated this industry practically to a lost art, and at the present time only one or two mills are now engaged in their manufacture.



Illustrating method of stocking and packing blackboards for shipment

Intensive Research Needed

Like many other industries in these highly competitive times, the slate business needs intensive research into the inherent capabilities and characteristics of the material itself as well as investigation into the adaptability of more modern methods of quarrying and manufacture, but operators are rapidly awakening to this need and with characteristic American ingenuity are applying themselves to the task. The quarry and plant of the Colonial Slate Co. is a typical example of this modern movement, and to the far-sighted initiative of such men as the Spry brothers, slate must look for its future.

Basic Slag Experiments in Agriculture

IN a note recently issued by the Dominion Experimental Farms, Ottawa, L. E. Wright, chemist, points out that experiments conducted by the Experimental Farms in the Maritimes and also on the Pacific Coast have shown that basic slag is a particularly valuable fertilizer for crops with a long season of growth—such as clover, timothy, turnips, mangels and corn. Basic slag is of value as a fertilizer by reason of its phosphoric acid content which not being immediately soluble gives the slag its slow-acting growth value. It has proved of special value in the improvement of heavy clay loams fairly well supplied with humus as from dressings of manure. As a rule, muck soils and soils deficient in lime, both of which types are apt to be acid, respond to applications of basic slag, the response being due in part to the alkaline character of this fertilizer through the presence of free lime.

Carefully conducted experiments in England and Scotland have shown that slag gives good results when applied to grass lands, bringing in the finer grasses and encouraging the growth of clover.

There are several types of slag on the Canadian market, varying as to total phosphoric acid and availability. The better grades will contain from 16 to 18% total phosphoric acid, and have a fineness of 80 or over.—*Canadian Chemistry and Metallurgy.*

Merger of Slate Quarries in Pennsylvania Possible

SLATE companies in Northampton county, Pennsylvania, and nearby districts are planning a merger which will involve about 60% of the producers, quarries and mills in the territory and would involve millions of dollars, according to a report in the *Philadelphia Inquirer*. Consummation is expected to be reached shortly.

It is reported that the group which is planning the consolidation has obtained options on all but one of the properties sought. Bankers back of the project are apparently satisfied, but no official announcement of the proposed merger has been made yet.

The consolidation, it is reported, would be both for production and sales. Quarries long established have been selected to go into the new organization, and if the merger goes through the slate products will be handled by the single corporation.

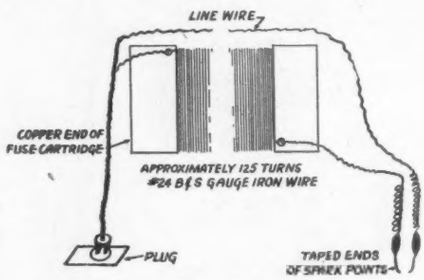
Hints and Helps for Superintendents

An "Electric" Match

By W. A. ERNST
Chief Chemist, South Dakota State Cement Plant, Rapid City, S. D.

MATCHES are an indispensable article around a laboratory. It frequently happens, however, that when a match is needed the match box is found to be empty. This, to say the least, is annoying and inconvenient.

Those who have gasoline blast lamps which require preheating with alcohol, or



Details of the "electric" match

some other fuel to contend with, realize that time is wasted looking for matches after the preheating pan under the burner has been filled with alcohol ready to be lighted.

It is with this in mind that the writer installed the spark coil shown in the illustration. Primarily, it was intended as a source of ignition for the determination of B.t.u. in coal, using a Parr calorimeter, but it soon became apparent that it could be used for other purposes as well. Consequently, another set of wires were attached to the coil and these were used for lighting blast lamps, etc.

By running a general wire from the coil around the laboratory and tapping in wherever a burner is located, it may be extended to suit most any condition, or for any number of Bunsen burners in the laboratory.

The coil can be easily made by anyone, since the one shown in the illustration is simply an old fuse cartridge having a diameter of 1¾-in. and a length of 6¾-in. wrapped with approximately 125 turns of fine iron wire (according to the intensity of spark desired) and then covered with shellac. Wires can then be attached to the terminal screws and conducted to any desirable place on the table.

The copper lead wires are nothing more than ordinary lamp cord, which is composed of two wires. One of these has been cut, as shown in the sketch, in order to insert the resistance coil, the other wire is the line wire. This can be further improved by causing it to pass through a fuse block, so as to safeguard against any short circuit which might cause a fire. However, this is usually taken care of by the fuses at the electric meters, so it need not be taken into account.

The spark points are taped to protect the operator's hands from getting a shock. All that is necessary now is to bring the points together and a fairly strong spark results.

The coil is put into commission by plugging in on any light or wall socket, or as shown, where the table is fitted up with attachments for plugging in hotplates, small motors, etc.

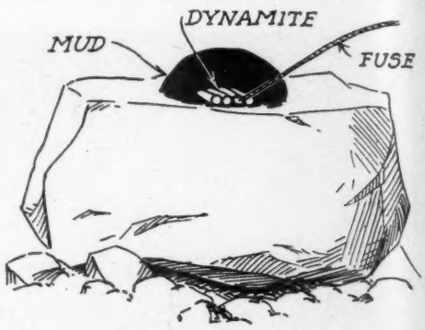
Accordingly the "match" is always on the job when wanted.

Some Mudcapping Hints

IN CHOOSING the kind of explosives to use for this work, the quickest and densest type should be selected because of the unconfined nature of the shot. Blasting gelatin has such a high velocity, even unconfined, that it is perhaps the most effective of all high explosives for mudcapping, but it is the most expensive and sometimes, for obscure reasons, it fails to develop its usual velocity. Probably the ideal explosive for mudcapping is 60% straight dynamite, as it combines satisfactory density with great quickness without the vagaries of unconfined gelatins. For medium hard rock, 40% straight is largely used and with entirely adequate execution.

"Electric" match lighting a Bunsen burner

Mudcap blasts may be fired with either cap and fuse or electric blasting caps. Cap and fuse firing is cheaper than electric firing and simpler than connecting wires from a number of charges. On the other hand, electric firing is safer where the blocks to be broken are so close together that the shots that go first, if fired in rotation, may blow the charges off nearby rocks so that only the primers from these charges will explode, and unexploded dynamite may be left mixed with the broken rock.



A mudcapped charge

The best position for the dynamite charge in mudcapping is in a depression in the top of the rock. Sometimes, however, it is desirable to blast a rock from the side, and if the explosive can be propped up against the rock with a stick or board, this can be done. When possible the charge should be placed so as to take advantage of the natural cleavage planes in the rock. Frequently the dynamite cartridges are simply laid in a pile on the rock. It is probably better to take the explosive out of the shells, press it together into a compact mass and cover it with the shell paper to keep it dry. Many blasters think it is worth while to dig a shallow pocket in the rock for the explosives, if the rock is soft enough. In any case, the pile of dynamite should not be very high, since it is the explosive in contact with the rock that does the work. The detonator should be placed in the top of the heap of dynamite, pointed toward the bulk of the charge. This gives the dynamite the best chance to develop its highest speed, which in mudcapping is equivalent to its highest efficiency.

Wet clay is the best material for covering the charge; the heavier the mud, the better the results. The clay should be screened while dry to take out all pebbles or pieces of rock. Any fine stone in the stemming ma-

terial is thrown by the explosion with great speed and force and such missiles have been known to injure persons a considerable distance away from the blast.

It should not be attempted to break up a very large boulder in one shot by firing two charges on it in the same round. With cap and fuse, the first one to explode is likely to scatter the second charge and, with electric detonators, there is a chance—only slight to be sure—that one may fail with the same result of scattering unexploded dynamite. In any case, it is better to see what one charge will do first, as the blaster can then judge more accurately the quantity needed for the second charge and the best place for it.—*Explosives Service Bulletin.*

Man Lift in Pack House

THE "man lift" shown in the cut is standard equipment, but its use in the rock products industry is new enough to justify giving it a place in this department. It is in the pack house of the new plant of the Trinity Portland Cement Co., Houston, Texas, which was described in the December 10 issue of ROCK PRODUCTS.

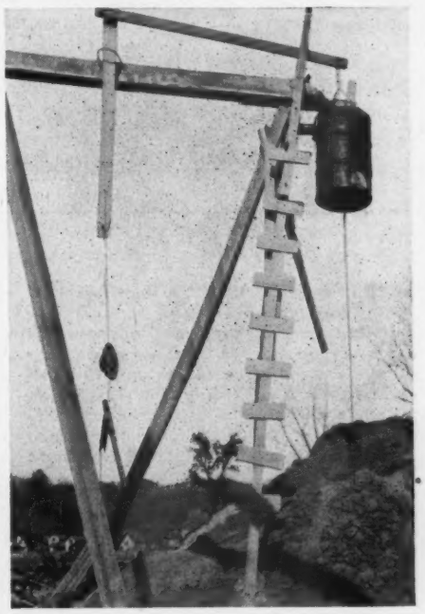
The advantages of a man lift are that it saves time and makes the working conditions more comfortable. The freight elevator moves slowly, of necessity, and the man lift takes men to the upper floors in much less time. Often men will lose time waiting for the freight elevator, when it is occupied on another floor.

Men will look after things better if it is made easy for them to reach the different working places. Where there are four floors, as there are in this pack house, it pays to have some convenient way to get men to the upper floors, for this reason. A minor reason for using a man lift is that it requires less power than the freight elevator.

Man lift in a pack house

Home-Made Sand Dewaterer

AN inexpensive device for removing water from sand as it passes from the washing plant to the stockpile is shown in the accompanying view. The sand and water comes down a wooden trough from the screens and falls into a large size can (such as an old oil barrel), which is hung at one end of a lever beam. The other end of the beam is weighted so as to just balance the can and its contents. Attached to the end of the wooden trough, and extending straight down through the center of the can, is a long stick which is tapered at the lower end, and this tapered portion fits snugly into a round hole in the bottom of the can. To complete the arrangement there is an outlet near the top of the can where the waste water is run off and carried away from the stockpile.



Simple sand dewatering device

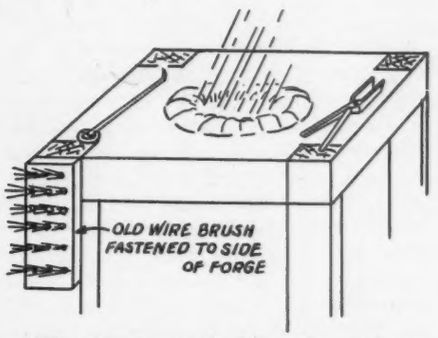
The operation of the device is simple enough. When the can is empty or only partially full its weight does not balance the weights at the other end of the beam and consequently it is held firmly up against the tapered end of the center stick and neither water nor sand can pass out through the bottom hole. As more sand and water flows down to the can the sand settles to the bottom, while the water on top drains off through the outlet. The settling sand, being heavier than the water which it displaces, finally becomes greater in weight than the counterbalances at the other end of the beam, and the can automatically lowers itself, thus removing the tapered plug from the hole in the bottom and permitting a fine, but steady, stream of dewatered sand to fall to the stockpile below. It occasionally becomes necessary to clean out the accumulated sand in the can since all the sand will not flow down when it is emptying. This device can be used very satisfactorily where the production is not too great. It was devised and is being used successfuly by the East Peoria Sand and Gravel Co. of East Peoria, Ill., where two or three such outfits are in constant operation.

A Forge-Shop Hint

By CHARLES LABBE

Clarkdale, Arizona

TO remove the scale of red hot iron before welding or to clean the end of a drill bit just before hardening, an old wire brush can be used with good advantage. The brush is fastened on the working side of the forge towards the anvil either by nails, wire or bolt. When a hot piece has to be cleaned it is easy to quickly rub back and forth on the brush without having to bump it on the anvil and possibly bend it. The brush, being fastened, cannot be mislaid and leaves both hands free to attend to the work.



Wire brush attached to side of forge removes scale from red-hot iron

Welding Repairs on Eccentric of a Gyratory Crusher

AT A CERTAIN plant the eccentric of a 42-in. gyratory crusher developed a crack which on inspection was found to be about 54-in. long and 3-in. deep. The crack was in the form of an L, extending to the smaller end.

The eccentric was removed and further inspection revealed that the large ring gear on the end of the eccentric would have to be removed if a new casting were ordered for replacement. This meant a great deal of work since the gear was not only keyed on, but was also shrunk on the eccentric. Oxwelding was suggested as the solution, and as the casting was larger than any that had been handled previously in the plant welding shop, a service operator was called in to advise the plant operator in setting up and bronze-welding the job.

After the edges had been beveled properly, the actual work of welding was started, the ordinary practices for bronze-welding being employed. The welding took about six hours and about 70 lb. of bronze welding rod were used. It was not necessary to preheat this casting in order to bronze-weld it. —*Oxy-Acetylene Tips.*

Safety First in Large Scale Blasting Operations

Precautions in Using Power Current on Exploders

By W. L. Home
Consulting Quarry Engineer, Pine Plains, N. Y.

AROUND quarries where live wires are used for blasting purposes one should make the words SAFETY FIRST more than a mere slogan. Experience has proved that the following system will reduce to a minimum, accidents and missed holes, which are more than costly in time and money.

In securing the power for blasting purposes, do not hook on to any live line that may be available. Instead, run an independent line for blasting purposes only, and see to it that this line is always dead except when it is actually in use. Also, care should be taken that this line is sufficiently heavy, well insulated, and located far enough away from operations so that the installation can be more or less permanent, with substantial and dependable construction. One end of this line should be located in a "bomb-proof" shack, far enough away from the work to be safe, but in such a place that the blaster has a full view not only of the scene of operations, but also of all approaches to the dangerous vicinity of blasting.

From here the line should run parallel to the long axis of the operation, but 150 or 200 ft. removed from it. This line should be insulated in all places and provided with outlets at frequent intervals. These outlets should be of a type different from any others used on the job, so that no other than the blaster's plug will be able to plug in and make connections. Also the blaster would not be able to plug in any other outlet than the proper one. They should be of a weather-proof variety and put in so that no bare parts of the line are ever exposed. Heavy, well insulated, flexible extension cords equipped with the proper plugs to connect in with the outlets on the blaster's line should then be provided long enough to reach from the main line outlets to the leads from the electric exploders.

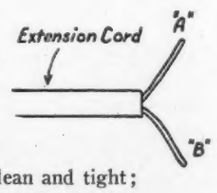
Connection to the main blasting line from the power circuit should be made in the blaster's shack. At the termination of the power circuit in the blaster's shack should be a light, fuses, and a knife switch. This light should always be burning to show that the power is on. The other side of the knife switch through the fuses should be connected with the knife switch for blasting. This knife switch for blasting should be placed in a box specially constructed for the purpose, with a door and lock. On the door of the box should be placed a block of wood, so that when the door is closed it is impossible for the knife switch to be in a closed position. Only when the door is open can one throw in this switch. The key to this switch box should be given only to that particular person who has charge of the blasting and who does the actual work of putting off the shot. Another key should be kept in a safe place in the office for emergencies. Provide plenty of long extension cords. Except for testing purposes we have now provided all the equipment necessary for the maximum amount of safety and convenience.

Author's Note

IT may be well to mention that the writer worked up this system, tried it out, and knows that is as good and foolproof as any system ever found for a large job such as I used this on. With this system, while in charge of the excavation and blasting on the Conowingo dam project, built by Stone & Webster, Inc., I have fired successfully as high as 800 holes at one time, and I have found no reason to believe that a thousand could not be handled just as easily.
—The Author.

Connecting Exploders

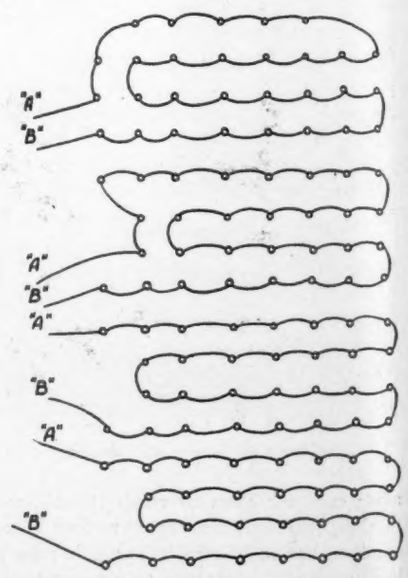
When connecting large numbers of exploders, arrange the work systematically. Cut the exploder wires as short as possible; have all connections clean and tight; throw all cut-off wire, iron, anything that may cause a short circuit, out of the vicinity of the shooting. In fact, anything that tends to make it difficult to inspect the wiring should be eliminated.



If the ground is wet, raise all connections out of the water. The method of connecting the exploders will depend on how many detonators are to be fired. In shooting large numbers of holes with a 220-volt 60-cycle alternating current line it is safe to connect 30 No. 6 exploders in parallel, provided the line exploder wires are short and the connections clean and well made. Should it be necessary to shoot several hundred or a thousand holes at the same time, this method is still reliable and easy to hook up and to check. No matter how big the shot or how many holes it is necessary to fire at one time, connect the groups of approximately 30 in a group, running out the leads with connecting wire to a convenient place.

Take pains always to be sure that there are about the same number of exploders in each group. Count the number of exploders or primers leaving the powder house and count the number of holes in each group, afterwards totaling up the number of holes connected in the entire shot. If this total is correct and balances with the number of exploders checked out of the powder house, you are certain that all holes are connected in. Even though each detonator was tested

Showing how to Connect Wires



All "A" Wires to "A"
All "B" Wires to "B"

Diagram illustrating method of connecting wires for a "safe" shot

before leaving the powder house, each set of lead wires from the groups of 30 each should be tested with the ammeter. After all the parallel groups of 30 are tested, four of these groups may be joined together. One must accomplish this next step with extreme care in order to insure success with the system. At this point in the procedure mistakes are likely to occur.

Grouping the Lead Wires

Take the lead wires from four groups of 30, twist the proper wires together so that the four groups are connected in series, being careful to use great caution in getting the right wires together for each series or a group, or more will fail to go. These twisted ends will now be the lead for the big group of 120 holes which are sufficient for one extension cord from the main blasting line. For every group of 120 holes run out another extension line. The mechanical part of the work is about finished and if everything has been done as outlined we are ready for the big shot.

To be sure that everything remains that way, this "wire-up" should be well guarded until the last minute for shooting has come. When the shooting time arrives, blow the first blasting signal as if you mean business; then connect each group of 120 to its extension cord. When all connections are made to the lead wires, plug in the extension cords to the blasting line. The blaster then retreats to the blasting shack to pull the shot. His next step is to blow the final whistle, to see that everybody is in the clear, and that all approaches are guarded. It is now time to throw in the switch which connects the power circuit to the blasting circuit; to unlock the door to the blasting switch and to pull the shot. After the shot is pulled, close and lock the door to the blaster's switch; open up the power switch; blow the "all over" whistle.

Checking Up Shot

The blaster and all his men should then go thoroughly over every part of the shot searching for any possible missed holes, testing out any suspicious-looking wires. Should misses be found, connect them up and shoot them at once. Needless to say that after every shot every extension line should be tested out, coiled up, and put in its proper place in the blaster's shack. Also test out the main blasting line at frequent intervals.

In conclusion I might add that one source of constant danger comes from undue familiarity with the blasting signals. Insist that not over two or three minutes elapse between the first and second signal. After the last whistle the blast should go immediately. If this rule is always obeyed, workers will understand and they will go out of the road at all times.

Also, wherever there are steam dinkeys there are sure to be sparks and fires. When loading a shot anywhere near a steam dinkey the powder should be taken out of the original box at a safe distance from the job itself, all the sawdust and paper removed, and the powder put back and kept covered at all times. The primers should be in a specially prepared covered box kept just for that purpose, and all other known precautions observed. Above all, do not use electric exploders during a thunder storm. Under such conditions get the shot off at once and stop loading. If it is impossible to shoot, disconnect all wires, get away and stay away until safe to go ahead.

If those responsible for work of this kind will conscientiously supervise and insist upon the precautions as outlined, the words "SAFETY FIRST" will have a meaning for all connected with the job.

Explosive Makers Campaign to Stop Accidents to Children

THE Institute of Makers of Explosives is carrying on a campaign to prevent accidents to children caused by their handling explosives, and particularly blastings caps. Since practically all rock products industries are large users of explosives, the campaign should be given particular note in our field. No matter how careful users may be, there is bound to be some cap or dangerous explosive left unheeded where children may find it. To prevent accidents the children must be taught what the cap looks like and must be made to understand that it should be left strictly alone. It is along these lines that the Institute is carrying on its campaign. One of the large posters used in the campaign shows how a blasting cap was set off by a baseball, a shoe and a lead pipe, obviously all articles with which a child is familiar. In this way the child is taught what he should do, and it is up to workers in the rock products industry to do their part by showing the greatest care about not leaving explosives where some careless or untaught child may find them.

Agricultural Lime as a New England County Agent Sees It*

By R. A. Payne
County Agricultural Agent
Northampton, Mass.

COUNTY AGENTS during the last six years have come to appreciate that lack of lime is one of the limiting factors in the production of most of the crops in New England. In other words, they have seen that farms need lime. It has been their observation that farmers having acid land, in time, grow to look like the crops that their land produces. Having ascertained the need for lime, the next thing they did was to demonstrate the fact that lime pays on a variety of crops. In this way they have broken down sales resistance for the lime salesman.

It has been my observation that very few of the lime manufacturers show any interest whatever in the sale of agricultural lime. In many cases the county agent has had to fairly beg local men to become representatives of the lime companies, so as to assure themselves and their neighbors of a source of lime. This has been a rather difficult piece of work, because established dealers in agricultural supplies state that the lime companies give them no protection. A farmer buying one car of lime gets as good a price as a dealer handling five or ten cars. This situation should be remedied if lime sales are going to go forward as they should.

This past year I had one experience which is altogether too common. I was able to show one Polish farmer that it would be to his advantage to use lime on his onion land. He needed a carload. A salesman came around and offered to sell him agricultural lime at $11 per ton, f.o.b. the plant, the farmer to pay the freight of approximately $3. This particular company quoted lime at $5.50 per ton at the plant and enabled this salesman in selling the full carload to get a margin of $5.50 per ton in a carload lot for simply taking this man's order. Needless to say that the county agent, after breaking down sales resistance and making it easy for the salesman to get the order, did not feel very friendly towards this particular man. The salesman, while he made a fine thing on this sale, has permanently injured himself with this man and with this man's friends.

The lime manufacturers have the power in their hands to perform a great service for New England agriculture by supplying lime at reasonable prices, establishing dealers in strategic points, and by intensively working the territory where their delivered price gives them a chance to compete with other companies.

The lime business as far as agriculture is concerned is still in its infancy. Volume can be built up, and I believe it is through volume of business rather than large margins that this department of a lime business can be made profitable.

*Abstract of a paper read at the First New England Lime Conference, Amherst, Mass., July 13, 1927. (See ROCK PRODUCTS, August 6, 1927.)

Bureau of Mines Report on Stone in 1926

THE United States Bureau of Mines has recently published a report by A. T. Coons on the production of stone in 1926. This pamphlet is a portion of the larger report on the "Mineral Resources of the United States for 1926," which has not yet been completed. The present report indicates that in 1926 more stone was sold and the value of the stone was 8% greater than in 1925. The report shows the production by states in 1923 and 1926 of all kinds of stone, with tables showing the amounts used as crushed stone, building stone and for other purposes. Figures on the valuation of all classes are likewise given, making the report a complete summary of the stone industry for the year.

Technology of Gypsum Plaster Materials*

Part I.—Effects of Calcination Temperatures on Properties of Gypsum —Nature and Utilization of Anhydrous and Dead-Burned Gypsum

By Otto Fr. Honus

HYDRAULIC materials derived from gypsum constitute an important part of the structural materials industry. Tests, aiming to replace the water in gypsum by oxides of the alkali earth group (CaO, BaO, SrO), have shown that the resulting compounds have good hydraulic properties. The formation and behavior of these compounds will be treated further along in this article. It will suffice here to discuss their use in the light of the test results recorded to date. The theoretical conclusions were followed up by a series of empirical tests on the effects of impurities occurring in the natural rock gypsum. Anhydrite, chemically precipitated gypsum, hydrous gypsum and limestone of various origins, all of these materials being important from the point of view of the manufacturer, were studied.

Before proceeding, a review of the present knowledge of gypsum will be useful. Study of available literature reveals that previous definitions of plaster of paris, anhydrous (Estrich) gypsum and dead-burned gypsum are contradictory. This is due to the fact that in many cases the recorded temperature was not that of gypsum but of the medium surrounding it. Also the variation of the gypsum samples in the different series, with regard to purity and chemical composition, must have had its effect.

Formation and Properties of Gypsum Plastics

The formation and properties of plaster of paris, anhydrous gypsum and dead-burned gypsum have frequently been made the subject of scientific investigation. Thus, according to Senft (*Notizblatt*, p. 236, 1878), gypsum exposed to the sun for some time loses several per cent of water and becomes unsuitable for calcination. The temperatures required for the driving off of the water have been variously recorded by Lavoisier, Payen, Millon, Plessy, Graham, Berthier, Landrin, Le Chatelier and others. Zeidler (*Dinglers Polytechn. Journ.*, p. 470, vol. 180) tried to eliminate errors by adhering strictly to the temperature of gypsum and not to that of the surrounding medium. Heating in an air current or in still air has an important effect on the temperature. For example, pure mica loses over 20% water in an air current at 110 to 120 deg. C., while only 15.6% water are lost at 150 deg. C. without an air current. According to Zeidler, the driving off of the water in an air current begins at 90 to 96 deg. C.; after about 15% water is eliminated, this process is stopped even when heated for longer periods at 100 deg. C. It sets in again at 150 deg. C. and ends at 170 deg. C. According to Plessy, all water is eliminated at 110 to 115 deg. C. (*Comp. Rendus Acad. Sc.*, p. 658, vol. XXIV). Millon's tests (*Ann. de Chim. et de Phys.*, p. 222, vol. XIX) show this to occur at 200 to 300 deg. C., when about 20% water is driven off. Water is driven off, slowly, yet uniformly between 105 and 130 deg. C.; this process is broken between 130 and 150 deg. C. and is resumed again at 150 deg. C. to continue slowly and uniformly up to 170 deg. C.

THIS is the first installment of an excellent and comprehensive review of the scientific status of gypsum mortars and plasters. The author has conscientiously selected his references to make his paper a valuable and instructive compilation of existing knowledge of the properties of gypsum in its varied physical and chemical forms.—The Editors.

Gypsum Phases

The driving off of the water at different temperatures is an important indication of the different phases of gypsum. According to Berthier (*Ann. des Mines*, p. 655, 1841), plaster of paris contains 4 to 8% H_2O and, according to Payen (*Erdmanns Journ. f. Okon. Chem.*, p. 471, vol. 7), gypsum begins to lose its water at 115 deg. C. Subsequently Zeidler's observations were confirmed by Le Chatelier (*Ann. des Mines*, p. 346, vol. II, 1887), who distinguishes two phases. At 180 deg. C. the $CaSO_4 \cdot 2H_2O$ phase is reduced to $CaSO_4 \cdot \frac{1}{2}H_2O$ (later interpretations call this $2CaSO_4 \cdot H_2O$ with 6.2% water), in which form it is commonly used as plaster of paris. Dehydration is not completed at 155 deg. C., but at 194 deg. C.

Gunning (*Polytechn. Centralbl.*, p. 1451, 1871), who produced gypsum artificially by precipitating it from a $CaCl_2$ solutions with diluted sulfuric acid and washing the precipitate in dilute alcohol solution, established that the water of crystallization is lost slowly but completely in the steam bath.

When burned to temperatures over 200 deg. C. (dead-burned), gypsum loses its ability to harden with water on account of sintering. Such is the common belief. According to Zeidler (*Dinglers Polytechn. Journ.*, p. 471, vol. 180), incomplete hardening and a crumbly mass were the results of burning gypsum to 210 deg. C. All hardening ceases at 220 to 225 deg. C. The latter values agree more closely with the temperature of dead-burning given by Graham (204 deg. C.), than with that of Mitscherlich (160 deg. C.).

Effects of Continued Calcination

Investigations by Schott (*Dinglers Polytechn. Journ.*, pp. 52 and 355, vol. 202) and Michaelis led them to conclude that there was no dead-burned gypsum, entirely indifferent to water, but that calcining at higher temperatures resulted in a new hydraulic phase, i. e., a gypsum capable of combining only with small quantities of water on account of greater density and one which hardened only after several weeks. According to Michaelis, at 1200 deg. C. anhydrous gypsum in contact with water again returns to the crystalline phase. Schott suggests the following classification: (1) crystalline gypsum containing 20.93% water of crystallization; (2) three-fourths dehydrated gypsum (plaster of paris with 4.27% H_2O) quickly hardening with water; (3) completely dehydrated gypsum, dehydrated at not higher than 200 deg. C., which sets quickly with water; (4) anhydrite, non-hydraulic, capable of slowly absorbing water; (5) gypsum calcined at 400 to 500 deg. C. (red heat) absorbs water slowly and possesses hydraulic properties. Although such overburned gypsum is less soluble in water than that burned at ordinary temperatures, it is not suitable for use under water.

Calcination of Lime-Gypsum Mixes

The first tests, attempting to sinter or fuse gypsum with an admixture of lime in a furnace, were carried out in England by

*Zement (1927), 1201-1204.

Y. D. Scott (*Dinglers Polytechn. Journ.*, p. 202, vol. 146). The resulting product gave a dense mass with strongly hydraulic properties; a similar product had been previously obtained by bringing lime in contact with the fumes of burning sulfur, the lime no longer slaking, yet having hydraulic properties, when ground. Schott (*Dinglers Polytechn. Journ.*, pp. 52, 355 and 513, vol. 202) obtains this product with greater facility, as he claims, by heating in a Siemens furnace, to a white heat, a mixture of gypsum or soda ash with lime, calcined or raw, in the proportion of about 1000 parts gypsum to 735 parts limestone. The mass is crushed to about sand-grain size, with a certain amount of fines. Excess water should be avoided in mixing. The product hardens satisfactorily but is less suitable for structures exposed to water than for use in other places such as stucco plaster. When mixed with the proper quantity of water, this product shows a gradual set only after half a day, and can still be scratched with the fingernail. It gradually acquires under water the hardness of an average hydraulic lime. Schott's "cement" has a density of 3.307, against 3.20 for portland cement. Mixtures of lime and a gypsum made in this manner combine with more water, than hydraulic gypsum alone, the increase being proportional to the lime admixture, and resulting in a tendency of the mixture to unsoundness.

The work of Landrin (*Polytechn. Centralbl.*, p. 1241, 1874) quotes data similar to Schott and ascribes the hardening of gypsum with water not only to the temperature of burning, but also to the period of burning. Gypsum burned at 150 deg. C. still retains 7 to 8% water; in heating it to 400 deg. C. all water is driven off in 40 minutes and the product yields a resistant, quick-hardening mortar. If this temperature (400 deg. C.) is maintained for 3 hours, the product still yields a resistant mortar when mixed with water, but hardening takes place almost immediately. When maintained at this temperature for 24 to 26 hours, the mass hardens with water, yet can be scratched by the fingernail. Gypsum burned at dark red heat still retains the property of hardening with water; when burned to cherry red heat it is no longer capable of combining with water.

Hauenschild (*Töpfer- u. Ziegler-Ztg.*, p. 66, 1882) gives the range of tensile strength of gypsum as from 11 to 12 kg./cm.^{2} (156 to 180 lb./in.^{2}). Thus gypsum with 50% water added yielded a strength of 13.75 kg./cm.^{2} (190 lb./in.^{2}); with 75% water only 6.6 kg./cm.^{2} (94 lb./in.^{2}).

Effect of Admixtures on Time and Set of Gypsum

The method of pulverizing has an important effect on the strength and certain mixtures affect the time of set and hardness of gypsum. The set is accelerated by KCl, NaCl and $BaCl_2$ (of which only the latter gives a simultaneous rise in strength), as well as by $Ca(OH)_2$ and $Ba(OH)_2$. Nitrates accelerate the time of set, but reduce the strength. Sulfates, when used in limited quantities, may improve the strength and quality of the product. Certain salts have a beneficial effect on the raw, powdered gypsum, which does not harden with water.

Thus immediate-setting gypsum was obtained by Emmet (*Dinglers Polytechn. Journ.*, p. 477, vol. 49) by mixing with gypsum, solutions of K_2CO_3, K_2SiO_3, K_2SO_4 and $C_4H_4O_6KNa$. According to Emmet, sodium salts are not effective, but in recent years, however, these have come to be used successfully, a point which will be covered in detail later. The admixture of salts to gypsum is based on the substitution of one molecule of water of crystallization. Raw gypsum with such salt admixtures hardens like calcined gypsum. It should also be mentioned, that gypsum hardened in this manner, when pulverized and again mixed with a solution of one of the above potassium salts, hardens again. This property can be taken advantage of in the case of gypsum stored for long periods, which loses the ability to harden with water satisfactorily, by mixing the stored gypsum with a potassium salt solution instead of water. Calcined gypsum should be protected from moisture during storage.

Conditions Producing Normal Plasters

As conditions for producing a normal gypsum plaster, Lorenz and Tieman (*Ztschr. f. Bauwesen*, p. 173, 1877; *Töpfer-u. Ziegler-Ztg.*, No. 19, 1877) give the following: Calcining to not higher than 130 deg. C., avoiding too fine grinding to prevent too rapid a set, storage away from moisture, early use and uniform rate of mixing with water, an excess of which should be avoided.

Gypsum, its properties and uses have been treated by G. Feichtinger (*Chem. Technologie d. Mörtelmaterialien*, p. 391, 1855); A. Moye (*Der Gips, Leipzig*, 1906); Varrentrapp (*Dinglers Polytechn. Journ.*, p. 389, vol. 166); Lunge (*Dinglers Polytechn. Journ.*, p. 391, vol. 189); Tomkins (*Chemische Ind.*, No. 6, 1879); Mayer (*Journ. f. Landwirtschaft*, p. 167, vol. 34); *Goessmann* (*Amerik. Chemist*, No. 82, 1887); Rohland, Glasenapp and Traube.

Casendini (*Polytechn. Centralbl.*, p. 1422, 1859) uses borax solutions of different concentration to retard the sudden set of gypsum. The more concentrated the solution, the slower is the hardening of gypsum. For example, one part by volume of a saturated borax solution with 12 parts by volume of water adds 15 minutes to the hardening time; 8 parts by volume of water adds 1 hour and with 4 parts water several hours are added. A basic admixture is also recommended.

Anhydrous or Dead-Burned Gypsum

If it is true that data pertaining to the formation of plaster of paris are contradictory, this is none the less true of anhydrous gypsum. No rules can be established regulating the formation of plaster of paris, dead-burned and anhydrous gypsum. Thus, according to Rohland (*Der Stück-u. Estrichgips*, p. 70), anhydrous gypsum is formed in the temperature interval of 525 to 600 deg. C. He later reduced this upper range to 400 to 500 deg. C. Van't Hoff and Just (*Baukeramik*, No. 12, 1907) assume the lower limit to lie around 400 deg. C. Von Glasenapp and investigations by P. B. Budnikoff and Syrkin (*Ztschr. anorg. Chemie*, p. 257, 1922) and Glasenapp (*Studies of Plaster of Paris, Dead-burned and Anhydrous Gypsum*, Riga, 1909) place the beginning of the formation of anhydrous gypsum at 750 to 800 deg. C. G. Feichtinger (*Chem. Technologie der Mörtelmaterialien*) designates gypsum dehydrated at 400 to 500 deg. C. as anhydrous gypsum; according to a state patent (*D. R. P.* 160,000, Kl. 80b.) anhydrous gypsum is gypsum calcined at red heat, which sets slowly when mixed with small quantities of water. Textbooks in engineering and inorganic chemistry contain such statements as one by L. Medicus (*Brief Text of Chem. Technology*) that gypsum burned at temperatures over 200 deg. C. undergoes a hydraulic modification and acquires the properties of anhydrous gypsum; H. Ost (*Text of Chem. Technology*, p. 275, 1922) denotes as indefinitely dead-burned gypsum the product calcined at 500 to 600 deg. C. and as anhydrous gypsum the product calcined at 1000 or even 1300 deg. C. in shaft and ring kilns. W. Mecklenburg (*Textbook of Inorg. Chem.*, p. 293, 1919) ascribes the formation of dead-burned gypsum to a further heating of the phase formed at 130 deg. C. and gives the formation of anhydrous gypsum at about 300 to 500 deg. C. According to Kraft (*Brief Text of Inorg. Chem.*, p. 476, 1914) gypsum loses part of its water in an air current at 80 deg. C., otherwise at 110 deg. C. Plaster of paris $2CaSO_4 \cdot H_2O$ is thus formed, which combines with water under heat evolution and hardens. Heated to 200 deg. C., gypsum loses all of its water, is dead-burned and combines with water without hardening; at 1000 deg. C., however, it goes over to the hydraulic phase, which contains slight quantities of CaO, reacts slowly with water and yields a hard mass with an alabaster-like surface.

Dehydration Temperatures

G. Feichtinger (*Chem. Techn. der Mörtelmat.*) refers to a phase of gypsum, which becomes dehydrated at temperatures not higher than 200 deg. C., and, contrary to anhydrous gypsum, reacts with water instantaneously. Van't Hoff and Just (*Min. Pruss. Acad. of Sc.*, Berlin, p. 249, 1903) observed that gypsum burned at 300 to 400 deg. C. sets more rapidly than that burned at 200 deg. C. Van't Hoff (*Tonind. Ztg.*, p. 429, 1902) artificially produced a phase of gypsum, which became completely dehydrated at 100 deg. C., yet maintained

rapid-setting properties. Van't Hoff is of the opinion that this phase may play a part in anhydrous gypsum. Rohland (*Ztschr. Angew. Chem.*, p. 1895, 1906) found anhydrous gypsum forming in the towers of an ammonia-soda process plant at temperatures of 100 to 120 deg. C. In a recent publication of P. P. Budnikoff and Syrkin (*Chem. Ztg.*, p. 825, 1923) the range of dead-burned gypsum is said to begin at 450 deg. C. and end at approximately 750 deg. C. It appears reasonable to calcine gypsum at high enough temperatures (*Mitt. des Deutsch. Gipsver.*, 1904) to make it lose the special properties possessed in an under-burned stage.

Hardening of Gypsum Plasters

Only in recent years have the studies of the processes taking place during hardening of plaster of paris been supplemented by studies of the same processes in anhydrous gypsum. These investigations have already resulted in the drawing of some practical conclusions. Thus F. Hartner (*D. R. P.* 312 239, Kl. 80b of July 19, 1917) patented a process of producing quick-setting cement from natural or artificial anhydrite which simply comprises pulverizing to a size of about 0.006 mm. Alkaline admixtures, particularly CaO and MgO or their hydroxides, are beneficial to hardening. An admixture of only 2.5% $Ca(OH)_2$ results in reducing the time of set to 4 to 7 hours and producing a mortar which shows at 28 days a tensile strength of 30 kg./cm.^{2} (425 lb./in.^{2}) on molded specimens. The $Ca(OH)_2$ or $Mg(OH)_2$ may be replaced by lime-liberating substances such as portland cement, slag cement, over-burned lime and calcareous building and quarry waste. This cement can be used in neat or mortar form and may be poured, rammed and tamped. The results of the investigations of this invention (*Ztschr. Anorg. Chem.*, vol. 33, 1920; also Platzmann, *Zement*, p. 525, 1920) are of a general interest as they throw a new light on the hardening processes and offer an explanation of the properties of gypsum formed at different temperatures.

Warren E. Emley (*Canad. Patent* 229,793, 1923) suggested that a definite quantity of water is the main condition of hardening; 0.5% water must be present with $CaSO_4$. Ground anhydrite with this quantity of water yields a gypsum capable of hardening.

Nature of Anhydrous Gypsum

The nature of anhydrous gypsum and the causes of its hardening have not as yet been solved. Investigations by v. Glasenapp (*Studies of Plaster of Paris, Anhydrous and Dead-burned Gypsum*, Riga, 1909) show that microscopic examinations reveal sulfate and a base in the anhydrous gypsum. White's process (*Journ. Eng. Ind. Chem.*, p. 5, 1909) also shows even less than 1% CaO. Budnikoff and Syrkin (*On the Dissociation of Calcium Sulfate at Higher Temperatures, Chem. Ztg.*, p. 22, 1923) find very slight contents of free CaO at 800 to 1000 deg. C. They suggest the following:

Deg. C.	Per Cent, CaO
At 800	0.09
900	0.12
1000	0.21
1100	1.14
1200	1.65
1300	3.00

Gypsum direct from the calciner at 1000 deg. C. gives a basic reaction with phenolphthalein. The color of the titrated liquid soon disappears due to the effect of the carbon dioxide of the air. The authors also report on the time of set and rate of solution of calcined gypsum (*Ztschr. Anorg. Chem.*, p. 257, 1922; also *Rep. of Polytechn. Inst. at Ivanivo-Vosnessensk*, 1922). Budnikoff (*Chem. Ztg.*, p. 825, 1923) tried to produce anhydrous gypsum by artificial means, heating a definite quantity of Kahlbaum gypsum at a temperature of 450 deg. C. for 3 hours and to constant weight and adding 1 to 5% CaO to each 2 gm. of dead-burned gypsum. The mixture was carefully mixed in crystalline dishes; surplus water was added and the mixture allowed to dry to constant weight for 7 days at 35 to 36 deg. C. The hydration of CaO was also taken into account.

Selivanoff's observations gave the maximum absorption of water by CaO at 32.51% instead of the theoretically computed 24.31%.

$CaSO_4$ gm.	CaO gm.	Water increase in weight	Increase in per cent minus the water retained by CaO
2.0913	0.0401	0.1124	5.0
2.0422	0.0498	0.0902	4.0
1.6550	0.0720	0.1234	6.5
2.0116	0.1000	0.4934	23.5
2.0012	0.0804	0.4974	25.0

Thus CaO admixtures make dead-burned gypsum active.

(*To be continued*)

The German Lime Industry in 1927

THE German lime industry received a considerable impetus as a consequence of the general rise in market prices, which characterized the past year throughout all lines of business. This is illustrated by the production and sales figures, which range beyond those of the preceding year. Limestone quarries in the first 10 months of 1927 exceeded by 13% the total output of 1926, according to statistics of the German Kalk-Bund. Similarly the production of lime during the same period exceeds that of 1926 by 11%. It is notable that these figures are even higher than those of the more favorable year of 1925, although the difference is slight. However, the mark set by pre-war production has not as yet been approached. Many plants were improved with a view to more economic production, particularly with regard to methods of burning lime. The lime industry of the western industrial districts was handicapped by a lack of skilled labor.

Increased sales are recorded by almost all lime companies, although the demand for lime in the sugar industry was slightly off. The building trades together with the lime-consuming building materials industries show a 36% increase of lime consumption up to and including October, 1927, over the corresponding period in 1926. However, this figure is somewhat misleading, as the 1926 lime market was very inactive, and great expectations were placed on 1927 as a result of official promises of increased appropriation of capital for building.

Imports, particularly of raw materials, and lime, increased by more than 90% above those of the preceding year, the exports in general experienced a drop of about 18%. Exports of ground limestone were 4% higher than in 1926.

It should not remain unmentioned that the reparations negotiations of the past year greatly threatened the prices of the lime industry. The wage wars which set in with the rise in business brought about an increase of wages in the lime industry, together with an increase in the prices of lime. The latter took place gradually due to the strong competition of the different lime-producing districts.

Considering the present conditions, it is difficult to speak of the future of the lime market through 1928. The most competent authorities disagree as to whether the present high level of prices will persist or will end within a short time. The results and experiences of the past year, from which so much was expected in every line, do not permit us to view the future with special confidence, as the shortage of capital, which is *the* problem of the building trades, is even greater than it was a year ago. The hope of the lime industry, aside from the building trade as consumer and aside from capital shortage, which is responsible for long-time contracts, etc., lies in getting the building trade and the materials industries to use lump and crushed lime on the same basis, and to get these industries to co-operate on early orders.—*Baumarkt* (1927), **50**, 1528.

Russian Graphite Reserves

NEW reserves of graphite discovered by the geologists of the United States of Soviet Russia are described in a recent report (Economic Review of the Soviet Union, January 1, 1928). They lie along the banks of the Kureika river and amount to at least 8,500,000 tons in one locality alone. The average carbon content is about 90%, and some of the impurities can be still farther romoved by winnowing and flotation. The graphite lies at a depth of only 12 meters and the thickness averages 15 meters. Though near the Arctic circle, the deposits are in a sehltered valley which affords a relatively mild climate. The region is accessible by boat along the Yenisei river through the summer months, as well as by rail from Krasnoyarsk. Ground graphite of 95 to 98% carbon contest is to be furnished. Tests conducted at the Leningrad Mining and Metallurgical Laboratory indicated the successful use of the graphite in carbon electrodes.—*Mining and Metallurgy.*

Editorial Comment

The Future of Concrete

The most interesting development in portland cement research at the present moment is the search to find ways and means of increasing the percentage of tri-calcium silicate, for this is generally conceded to be the component in portland cement which gives it the most desirable quick-hardening and early strength producing qualities. P. H. Bates, of the Bureau of Standards, says that the present tri-calcium silicate content of portland cement is from 25 to 50%, and that a 100% tri-calcium silicate would be worth its weight in gold —that is it would cost so much to make it by any known method that the product would be worth its weight in gold.

As a "permanent" cementing material its worth may not be any more than that of present "standard" portland cement, for such a thing as tri-calcium silicate does not exist in all nature. It is assumed therefore by geologists that tri-calcium silicate is an *unstable compound,* if measured in terms of 1000 years or more. The slogan of the portland cement industry has long been "Concrete for Permanence," and this expressed aim in manufacturing a cementing material, of course, should not be lost sight of in the desire to produce a product which engineers and builders for the moment may demand.

But regardless of the immediate object of portland cement research on the part of many individual manufacturers it is a healthful and hopeful sign that the industry is active on a wholesale scale in such activities. It is quality competition. And when we speak of quality competiton we do not infer a multiplicity of standards or a variety of specifications. The measure of quality at the present time is too undefined to justify setting up such standards. But the day is past when it can be said that portland cement is the same, from whatsoever manufacturer it comes.

Permanency Real Requirement

It seems to us that the one definite standard to maintain is that the concrete made with cement and aggregates shall have a specified strength and permanency at the expiration of a period long enough to determine these satisfactorily. If, in addition early high strengths are demanded for certain work, or by certain buyers, these can be provided for in the specifications for the *concrete,* not necessarily in the specifications for the cement; for early high strengths in concrete have been shown to be about as much a matter of right aggregates, correct proportioning, proper manipulation, and quantity of cement, as of the quality of the cement. If the purchaser wishes to accomplish his ends by use of an early high strength, or quick-hardening cement at a higher price than slower acting cements, it should be his right and privilege to do so. He is still, presumably, using a standard portland cement in all essentials except time of hardening of the resultant concrete.

The Construction Option

It seems to us the logical development in concrete engineering is toward specifications requiring certain strengths for certain kinds of work at the ends of certain periods of time. If this method is broadly adopted, as many people believe it will be, and early high strength concrete is desired, it will be largely a matter of option with the constructor or contractor to use more carefully prepared aggregates, more than the usual amount of cement, longer mixing periods, or a quick-hardening cement. It is a matter of engineering economics, as it should be, for him to determine which method to pursue.

A Common Problem

The problem is thus not one of the portland cement industry alone, but of the producer of aggregates and of the manufacturer of the concrete. For a long time it was possible to account for poor concrete by putting the blame on the aggregates. But as knowledge of aggregates has increased, and as producers of aggregates have become organized to maintain their side of the controversy, it was inevitable that some attention should become focused on the quality of the cement itself. It is inconceivable that the problem of "permanent concrete" will ever be solved without frankness in facing the issue and a thorough knowledge of every factor involved, and however distasteful it is from a commercial and merchandising point of view to recognize differences in standard portland cement, at least it is a step toward making concrete ultimately a better and more permanent engineering material.

Modern industry demands evidence of progress and development. If portland cement manufacturers did not show activity in research and a desire to improve their product, most assuredly research in other lines of hydraulic cements would be greatly stimulated. Good will have been accomplished even though it is eventually shown that present standard portland cement is the best material to use, all things considered. Few geo-chemists who know the character of the cementing materials used in nature's rocks will concede that tri-calcium silicate should be the ultimate goal of research in this direction. Some day one of these geo-chemists with a practical turn of mind may discover something yet more "permanent."

Financial News and Comment

RECENT QUOTATIONS ON SECURITIES IN ROCK PRODUCTS CORPORATIONS

(These are the most recent quotations available at this printing. Revisions, corrections and supplemental information will be welcomed by the editor.)

Stock	Date	Par	Price bid	Price asked	Dividend rate
Allentown Portland Cement Co. (common)[37]	Dec. 30	.....	3	7	
Allentown Portland Cement Co. (6% bonds, 1932)[37]	Dec. 5	.....	90	92	
Alpha Portland Cement Co. (common)[2] new stock	Feb. 11	No par	35	40	75c quar. Jan. 14
Alpha Portland Cement Co. (preferred)[2]	Feb. 11	100	.....	115	1¾% quar. June 15
American Lime and Stone Co. (7% bonds, 1942)[22]	Jan. 13	.....	100½	101½	
Arundel Corporation (sand and gravel—new stock)	Feb. 15	No par	46¼	46¼	50c quar.; $1 ex. Jan. 16
Atlantic Gypsum Products Corp. (1st 6's carrying 10 sh. com.)[10]	Feb. 16	.....	106	109	
Atlas Portland Cement Co. (common)[3]	Feb. 11	No par	39½	41½	50c qu. Sept. 1
Atlas Portland Cement Co. (preferred)	.....	100	.....	.....	2% qu. Oct. 1
Atlas Portland Cement Co. (preferred)[3]	Feb. 11	33⅓	43	.....	2% qu. Jan. 3
Beaver Portland Cement Co. (1st Mort. 7's)[8]	July 29	100	100	100	
Bessemer Limestone and Cement Co. (Class A)[4]	Feb. 13	.....	36½	37	75c quar. Feb. 1
Bessemer Limestone and Cement Co. (6½% bonds)[4]	Nov. 4	.....	100¼	101	
Boston Sand and Gravel Co. (common)	Feb. 10	100	77¼	80	$1 qu., $1 ex. Jan. 2
Boston Sand and Gravel Co. (preferred)	Feb. 13	.....	80	85	1¾% quar. Jan. 1
Boston Sand and Gravel Co. (1st preferred)	Feb. 13	.....	90	95	2% qu. Jan. 1
Canada Cement Co., Ltd. (new common)	Feb. 15	.....	33⅞	34	
Canada Cement Co., Ltd. (new preferred)	Feb. 10	.....	99½	99¾	
Canada Cement Co., Ltd. (new units)	Nov. 4	.....	107	107½	
Canada Crushed Stone Corp., Ltd. (6½s, 1944)[11]	Feb. 11	100	96	99	
Charles Warner Co. (lime, crushed stone, sand and gravel)	Feb. 8	No par	38	.....	50c quar.; 50c ex. Jan. 12
Charles Warner Co. (preferred)	Feb. 8	100	108	.....	1¾% quar. Jan. 26
Cleveland Stone Co. (new stock)	Feb. 13	.....	70	75	50c qu. 50c ex. Dec. 1
Connecticut Quarries Co. (1st Mortgage 7% bonds)[17]	Dec. 30	100	Called		
Consolidated Cement Corp. (1st Mort., 6½s, series A)[24]	Feb. 16	100	96	99	
Consolidated Cement Corp. (5 yr. 6½% gold notes)[24]	Feb. 16	100	95	98	
Consumers Rock and Gravel Co. (1st Mort. 7s)[13]	Feb. 10	100	99½	101	
Coosa Portland Cement Co. (6% bonds, 1944)[23]	Dec. 28	.....	65	75	
Coplay Cement Manufacturing Co. (6% bonds, 1941)[32]	Dec. 28	.....	50	.....	
Coplay Cement Manufacturing Co. (common)[29]	Dec. 20	.....	11	.....	
Dewey Portland Cement Co. (1st mort. 6's 1942)[30]	Feb. 16	100	99	101	
Dolese and Shepard Co. (crushed stone)[7]	Feb. 15	50	124	.....	$2 Apr. 1, $1.50 ex. Apr. 1
Edison Portland Cement Co. (common)[20]	Jan. 27	.....	50c	.....	
Edison Portland Cement Co. (preferred)[20]	Jan. 27	.....	1	.....	
Edison Portland Cement Co. (bonds)[20]	Jan. 27	.....	75	.....	
Egyptian Portland Cement Co. 7% pfd.[21]	Jan. 28	.....	90	95	1¾% quar. July 1
Egyptian Portland Cement Co. (common)[21]	Jan. 28	.....	5	7	40c quar. Oct. 1
Egyptian Portland Cement Co. (warrants)	Jan. 28	.....	No market		
Fredonia Portland Cement Co. (6½% bonds, 1940)[32]	Dec. 5	.....	97	101	
Giant Portland Cement Co. (common)	Feb. 11	50	35	45	
Giant Portland Cement Co. (preferred)	Feb. 11	50	40	45	3½% Dec. 15
Ideal Cement Co. (common)	Feb. 15	No par	99	101	$1 quar.; $1 ex. Jan. 1
Ideal Cement Co. (preferred)[28]	Feb. 15	100	110	112	1¾% quar. Jan. 1
Indiana Limestone 7's (1936)	Nov. 9	.....	98	100	
International Cement Corporation (common)	Feb. 15	No par	63¼	64¼	$1 quar. Dec. 31
International Cement Corporation (preferred)[2]	Feb. 15	100	109	111	1¾% quar. Dec. 31
Kelley Island Lime and Transport Co. (new stock)	Feb. 13	100	50	55	62½c quar. Jan. 1
Lawrence Portland Cement Co.[9]	Feb. 11	100	111	114	2% quar.
Lehigh Portland Cement Co.	Feb. 11	.....	64	69	1½% quar.
Lehigh Portland Cement Co. (preferred)	Feb. 11	.....	108	109½	
Lyman Richey Sand and Gravel Co. (1st Mort. 6s, 1928 to 1931)[12]	Aug. 12	100	99½	100	
Lyman Richey Sand and Gravel Co. (1st Mort. 6s, 1932 to 1935)[12]	Aug. 12	100	97½	99	
Marblehead Lime Co. (1st Mort. 7's)[14]	Feb. 11	100	100	.....	
Marblehead Lime Co. (5½% notes)[14]	Feb. 11	100	98	.....	
Michigan Limestone and Chemical Co. (common)[6]	Feb. 11	.....	40	.....	
Michigan Limestone and Chemical Co. (preferred)[6]	Feb. 11	.....	24	26	1¾% quar. July 15
Missouri Portland Cement Co.	Feb. 15	25	40	41	50c Feb. 1
Monolith Portland Cement Co. (common)[9]	Feb. 9	.....	14¾	15¼	8% ann. Jan. 2
Monolith Portland Cement Co. (units)[9]	Feb. 9	.....	33¼	34¼	
Monolith Portland Cement Co. (preferred)[9]	Feb. 9	.....	9¼	9½	
National Cement Co. (7% bonds)[26]	Feb. 10	100	96	99	
National Gypsum Co. (common A)[35]	Feb. 15	.....	22	24	
National Gypsum Co. (preferred)[35]	Feb. 15	.....	70	72	
Nazareth Cement Co.[39]	Feb. 10	No par	32	34	75c quar. Apr. 1
Newaygo Portland Cement Co.[1]	Dec. 30	.....	115	.....	
Newaygo Portland Cement Co. (6½% bonds, 1938)[32]	Feb. 11	.....	120	.....	
New England Lime Co. (Series A, preferred)[14]	Feb. 11	100	.....	95	
New England Lime Co. (Series B, preferred)[22]	Jan. 27	100	97	.....	
New England Lime Co. (V.T.C.)[22]	Jan. 27	.....	34	.....	
New England Lime Co. (6s, 1935)[14]	Feb. 11	100	98	100	
New York Trap Rock Corp. (6% bonds, 1946)[23]	Feb. 15	.....	101	101⅛	
North American Cement Corp. 6½s 1940 (with warrants)	Feb. 15	100	85¼	86	
North American Cement Corp. (units of 1 sh. pfd. plus ½ sh. common)[19]	Jan. 28	.....	40	45	
North American Cement Corp. (common)[19]	Feb. 7	.....	8⅞	9	2 mo. period at rate of 7%
North American Cement Corp. (preferred)	Apr. 25	.....	.....	.....	1.75 quar. Aug. 1
North Shore Material Co. (1st Mort. 6's)[15]	Feb. 16	100	99	.....	
Northwestern States Portland Cement Co.[27]	Nov. 21	.....	165	170	

[1]Quotations by Watling, Lerchen & Hayes Co., Detroit, Mich. [2]Quotations by Bristol & Willet, New York. [3]Quotations by Rogers, Tracy Co., Chicago. [4]Quotations by Butler, Beading & Co., Youngstown, Ohio. [5]Quotations by Freeman, Smith & Camp Co., San Francisco, Calif. [6]Quotations by Frederic H. Hatch & Co., New York. [7]Quotations by F. M. Zeiler & Co., Chicago, Ill. [8]Quotations by Ralph Schneeloch Co., Portland, Ore. [9]Quotations by A. E. White Co., San Francisco, Calif. [10]Quotations by Lee Higginson & Co., Boston and Chicago. [11]Nesbit, Thomson & Co., Montreal, Canada. [12]E. B. Merritt & Co., Inc., Bridgeport, Conn. [13]Peters Trust Co., Omaha, Neb. [14]Second Ward Securities Co., Milwaukee, Wis. [15]Central Trust Co. of Illinois, Chicago. [16]J. S. Wilson, Jr., Co., Baltimore, Md. [17]Chas. W. Scranton & Co., New Haven, Conn. [18]Dean, Witter & Co., Los Angeles, Calif. [19]Hemphill, Noyes & Co., New York. [20]Quotations by Bond & Goodwin & Tucker, Inc., San Francisco. [21]Baker, Simonds & Co., Inc., New York. [22]Pirnie, Simons and Co., Springfield, Mass. [23]Blair & Co., New York and Chicago. [24]A. B. Leach and Co., Inc., Chicago. [25]A. C. Richards & Co., Philadelphia, Penn. [26]Hincks Bros. & Co., Bridgeport, Conn. [27]J. G. White and Co., New York. [28]Mitchell-Hutchins Co., Chicago, Ill. [29]National City Co., Chicago, Ill. [30]Chicago Trust Co., Chicago. [31]McIntyre & Co., New York, N. Y. [32]Hepburn & Co., New York. [33]Boettcher & Co., Denver, Colo. [34]Kidder,, Peabody & Co., Boston, Mass. [35]Farnum, Winter and Co., Chicago. [36]Hanson and Hanson, New York. [37]S. F. Holzinger & Co., Milwaukee, Wis. [38]McFetrick and Co., Montreal, Que. [39]Tobey and Kirk, New York.

RECENT QUOTATIONS ON SECURITIES IN ROCK PRODUCTS CORPORATIONS (Continued)

Stock	Date	Par	Price bid	Price asked	Dividend Rate
Pacific Portland Cement Co. (common, new stock)	Jan. 29	.....	25	.....	
Pacific Portland Cement Co., Consolidated[5]	Oct. 21	100	61¾	.....	25c mo.
Pacific Portland Cement Co., Consolidated (preferred)	Jan. 29	.....	.....	82	
Pacific Portland Cement Co., Consolidated (secured serial gold notes)[5]	Jan. 27	100	98	99	3% semi-annual Oct. 15
Peerless Portland Cement Co.[1]	Feb. 11	10	1	1½	
Pennsylvania-Dixie Cement Corp. (1st Mort. 6's)[29]	Feb. 15	100	99	99⅜	
Pennsylvania-Dixie Cement Corp. (preferred)[28]	Feb. 15	100	95	97	1¾% Jan. 3
Pennsylvania-Dixie Cement Corp. (common)[28]	Feb. 15	.....	25½	25½	60c Jan. 3
Petoskey Portland Cement Co.[1]	Feb. 15	10	11¾	12½	1½% quar.
Pittsfield Lime and Stone Co.[21]	Oct. 8	.....	.....	100	
Pittsfield Lime and Stone Co.[21] (common)	Oct. 8	.....	.....	25	
Riverside Portland Cement Co.	Feb. 11	.....	180	200	50c monthly, $1.50 ex. Aug. 1
Rockland and Rockport Lime Corp. (1st preferred)[24]	Feb. 10	100	.....	100	3½% semi-annual Feb. 1
Rockland and Rockport Lime Corp. (2nd preferred)[24]	Feb. 10	100	.....	65	3% semi-annual Feb. 1
Rockland and Rockport Lime Corp. (common)[24]	Feb. 10	No par	.....	50	1½% quar. Nov. 2
Sandusky Cement Co. (common)[1]	Feb. 13	100	164	.....	$2 quar.; $4 ex. Jan. 1
Santa Cruz Portland Cement Co. (bonds)[5]	Jan. 26	.....	105	106	6% annual
Santa Cruz Portland Cement Co. (common)[5]	Feb. 11	.....	88½	92	$1 quar., $1 ex. Jan. 1
Schumacher Wallboard Corp. (common)	Feb. 11	.....	26	26⅜	
Schumacher Wallboard Corp. (preferred)	Feb. 11	.....	26¼	26½	
Southwestern Portland Cement Co. (units)	May 11	.....	205	.....	
Superior Portland Cement, Inc. (Class A)[20]	Feb. 9	.....	48¼	50	
Superior Portland Cement, Inc. (Class B)[20]	Feb. 9	.....	34	37	
Trinity Portland Cement Co. (units of 1 sh. pfd. and ½ sh. com)[27]	Feb. 11	.....	152	158	
Trinity Portland Cement Co. (common)[27]	Dec. 19	.....	50	60	
United Fuel and Supply Co. (sand and gravel) 1st Mort. 6s[27]	July 14	100	98	100	
United Fuel and Supply Co. (sand and gravel) 6% gold notes[27]	July 14	100	98	100	
United States Gypsum Co. (common)	Feb. 15	20	80½	81	40c qu. March 31
United States Gypsum Co. (preferred)	Feb. 15	100	123	.....	1¾% qu. March 31
Universal Gypsum Co. (common)[8]	Feb. 16	No par	4½	5¼	
Universal Gypsum V.T.C.[8]	Dec. 7	No par	3	3½	
Universal Gypsum Co. (preferred)[8]	.....	.....	.....	29	1½% Feb. 15
Universal Gypsum and Lime Co. (1st 6's, 1940)[3]	.....	100	73½	.....	
Union Rock Co. (7% serial gold bonds)[15]	Oct. 7	.....	Called as of Nov. 1, 1927		
Upper Hudson Stone Co. (1st 6's, 1951)[22]	Dec. 28	.....	92	.....	
Upper Hudson Stone Co. (1st 6's, 1937)[22]	Dec. 28	.....	Called		
Vulcanite Portland Cement Co. (7¼% bonds, 1943)[23]	Dec. 5	100	105	109	
Whitehall Cement Mfg. Co. (common)[26]	Feb. 11	.....	150	.....	
Wisconsin Lime and Cement Co. (1st Mort. 6's, 1940)[25]	Feb. 16	100	99	.....	
Wolverine Portland Cement Co.	Feb. 15	.....	6	6½	15c Feb. 15
Yosemite Portland Cement Co. (Class A, common)	Jan. 4	10	6	.....	

QUOTATIONS OF INACTIVE ROCK PRODUCTS SECURITIES

Stock	Date	Par	Price bid	Price asked	Dividend Rate
Asbestos Corp. of America (5 sh. pfd. and 5 sh. com.)[1]	June 22	.....	$1 for the lot		
Atlanta Shope Brick and Tile Co.[1]	Nov. 24	.....	25c	.....	
Benedict Stone Corp. (cast-stone) (50 sh. pfd. and 390 sh. com.)[1]	Dec. 29	.....	$400 for the lot	.....	
Blue Stone Quarry (60 shares)[2]	Mar. 16	.....	$10¼ for the lot	.....	
Coplay Cement Mfg. Co. (common)[4]	Dec. 16	.....	12½	.....	
Coplay Cement Mfg. Co. (preferred)[4]	Dec. 30	.....	70	.....	
Eastern Brick Corp. (7% cum. pfd.)[1]	Dec. 9	10	40c	.....	
Eastern Brick Corp. (sand lime brick) (common)[1]	Dec. 9	10	40c	.....	
International Portland Cement Co., Ltd. (preferred)	Mar. 1	.....	30	45	
Globe Phosphate Co. ($10,000 1st mtg. bonds, $169.80 per $1000 paid on prin.)	Dec. 22	.....	$50 for the lot	.....	
Iroquois Sand and Gravel Co., Ltd. (2 sh. com. and 3 sh. pfd.)[1]	Mar. 17	.....	$12 for the lot	.....	
Knickerbocker Lime Co.(x)	June 22	.....	100	.....	
Limestone Products Corp. (150 sh. pfd., $50 par, and 150 sh. com., no par)	Dec. 22	.....	$60 for the lot	.....	
Missouri Portland Cement Co. (serial bonds)	Dec. 31	.....	104¾	104¾	3¼% semi-annual
Olympic Portland Cement Co.(g)	Oct. 13	.....	.....	£1⅝	
Phosphate Mining Co.[1]	Nov. 24	.....	1	.....	
River Feldspar and Milling Co. (50 sh. com. and 50 sh. pfd.)[1]	June 23	.....	$200 for the lot	.....	
Rockport Granite Co. (1st 6's, 1934)	Aug. 31	.....	90	.....	
Simbroco Stone Co.[2]	Apr. 20	.....	12	12	
Southern Phosphate Corp.[6]	Sept. 15	.....	1¼	.....	
Standard Gypsum Co. (10 sh. pfd. and 5 sh. com.)[1]	Dec. 28	.....	$35 for the lot	.....	
Tensas Gravel Co. (180 sh. com.)[1]	Nov. 17	.....	$1 for the lot	.....	
Tidewater Portland Cement Co. (3000 sh. com.)	Dec. 22	.....	$6525 for the lot	.....	
Vermont Milling Products Co. (slate granules) 22 sh. com. and 12 sh. pfd.)[6]	Nov. 3	.....	$1for the lot	.....	
Wabash Portland Cement Co.[1]	Aug. 3	50	60	100	
Winchester Brick Co. (preferred) (sand lime brick)[6]	Dec. 16	.....	10c	.....	

(g) Neidecker and Co., Ltd., London, England. [1]Price obtained at auction by Adrian H. Muller & Sons, New York. [2]Price obtained at auction by R. L. Day and Co., Boston. [3]Price obtained at auction by Weilupp-Bruton and Co., Baltimore, Md. [4]Price obtained at auction by Barnes and Lofland, Philadelphia, Penn. [5]Price obtained at auction for lot of 50 shares by R. L. Day and Co., Boston, Mass. (x) Price obtained at auction by Barnes and Lofland, Philadelphia, on November 3, 1925. [6]Price obtained at auction by Wise, Hobbs and Arnold, Boston, Mass.

United States Gypsum Co.'s Annual Report

THE United States Gypsum Co., the largest factor in the gypsum industry, has thrown down the gauntlet by the adoption of a policy of meeting trade conditions, Sewell L. Avery, president of the company, told stockholders at the recent annual meeting, according to John A. Mirt, writing in the *Chicago Journal of Commerce*. Heretofore the company has not participated in the price cutting activities which have been a thorn in the side of the gypsum industry for a year or more, the report continues.

Directors of the company declared the regular quarterly dividends of 40 cents on the common stock and 1¾% on the preferred, both payable March 31 to stockholders of record March 15.

The board elected Charles W. Highley, president and general agent of the Hanover Fire Insurance Co., as a director to succeed Harry E. Brookby of Chicago, who resigned. Directors whose terms had expired were re-elected at the annual meeting of stockholders. All officers were re-elected.

Notwithstanding a loss of business by the policy in the last year, the report of the company and its subsidiaries for the year ended December 31 shows a consolidated net income of $7,538,508 after depreciation, depletion, federal taxes and all other charges, equal after preferred dividends to $10.10 a share earned on 691,198 shares of $20 par common stock outstanding. This compares with a net income of $8,375,747, or $11.35 a share on 687,875 shares, in the previous year. Had the price-cutting been met, Mr. Avery said, the profits would have been much lower.

But the U. S. Gypsum Co. has effected a considerable reduction in the cost of goods and the management enters the oncoming year with confidence, Mr. Avery declared. Improvement in the company's working capital position during the last year, with more than $7,400,000 in cash and marketable securities in the company's treasury, an in-

creasing sales force, new products coming out and no great building program ahead are other factors which are looked upon to bring the company through a period of high competition, which the U. S. Gypsum management faces with not the least pessimism, he indicated.

Plant capacity in the gypsum industry, far beyond present demands for gypsum products, was pointed to as one reason for the situation in that trade. In some products an overproduction of from 200% to 300% exists, it was declared, and the necessity of keeping plants going to meet overhead expenses has forced price-cutting which in some instances has amounted to 50% or more.

Competition More Severe

"Competition has been increasingly severe throughout the year," Mr. Avery declared. "The moderate decline in building has been most pronounced in those branches of the industry which our products serve. Additional competitive capacity has rendered these severe market conditions still more difficult, and in consequence prices have declined. In many sections they have reached so low a level on important commodities as to preclude a satisfactory profit."

This situation, Mr. Avery said, was taken into consideration at the November meeting of the board of directors when they declared only an extra dividend of $1 a share on the common in addition to the regular quarterly dividend of 40 cents, taking no action on a stock dividend for the first year since 1920. Experiences of the company in its early history also were considered.

"Any management which declares too much in dividends sooner or later comes to grief," he declared. "Too much conservatism can early be rectified without any damage, but once too much is declared and adversity hits there is no rectifying."

Pass Stock Dividend

He added that the declaration of a stock dividend made the management feel responsible to maintain cash dividends. The advisable thing he felt was to postpone such a dividend "until these clouds roll by."

Mr. Avery's attitude toward the common stock of his company was shown in an answer to a question from a stockholder who had purchased the stock at a much higher price and who desired to be informed as to what his course should be, whether to sell or retain his holdings. The advice was to retain the stock, since, Mr. Avery pointed out, the gypsum industry is a growing one and the company is a growing one.

A comparison of the company's report for the first six months of 1927 with the annual statement indicates a net profit of $3,646,206 after all charges in the second half, as compared with $3,892,302 in the preceding six months and $4,234,918 in the second half of 1926.

Record in First Quarter

During the first quarter of 1927 record earnings were shown, Mr. Avery declared, resulting primarily from a carryover of the large business at the end of 1926. The storm came in the second quarter of last year and in the final half the company struggled along under warlike competition, he said.

Despite the apparent severe competition ahead and a reluctance to make any predictions regarding the earnings outlook for 1928, Mr. Avery said:

"The outlook for tonnage for the first half of the year seems promising, and while a decline in profits is anticipated, it seems safe to expect a reasonably satisfactory earning for 1928."

The U. S. Gypsum Co. paid out less than one-third of its 1927 earnings in dividends, adding $5,190,411 to the surplus account, bringing that item to $24,233,219, the largest in its history. Most of this surplus was added to the property and plant account, which increased from $28,643,706 to $34,242,262 in the last year. Current assets were increased slightly, while a small reduction was made in current liabilities, resulting in a gain in net working capital from $11,904,873 at the end of 1926 to $12,485,341 as of December 31 last. Inventories were lowered by more than $300,000.

New Plants Cost $5,598,556

In connection with the increase in plant account, the annual report states:

"Expenditures for new plants, additions and improvements amounted to $5,598,556. These investments have brought into satisfactory operation an economic producing capacity, advantageously located, that has demonstrated its value during the latter part of the last year. It marks the near completion of a general plan designed to this end and undertaken three years ago. While the growth of the company's business and the changed market conditions will continually require plant investment, the needs for the ensuing year are expected to be reduced."

U. S. GYPSUM CO.'S CONSOLIDATED INCOME ACCOUNT AND BALANCE SHEET, 1924-1927, INCLUSIVE

Year ended December 31	1927	1926	1925	1924
Operating income	$ 9,961,466	$10,763,219	$10,474,302	$ 8,825,697
Depreciation and depletion	1,307,998	1,063,380	848,008	670,590
Federal taxes	1,114,960	1,324,092	1,212,178	988,725
Net income	$ 7,538,508	$ 8,375,747	$ 8,414,117	$ 7,166,381
Preferred dividends	554,552	567,563	579,925	592,077
Common dividends	1,793,545	6,116,089	3,790,002	4,292,515
Surplus for year	$ 5,190,411	$ 1,692,095	$ 4,044,189	$ 2,281,789
Surplus paid on capital stock	237,826	322,915	150,101	1,301,344
Surplus January 1	18,804,982	16,789,971	12,595,681	9,012,547
Profit and loss surplus	$24,233,219	$18,804,982	$16,789,971	$12,595,681
*Earned a share on common	$10.10	$11.35	$15.45	$14.96

*On 691,198 shares in 1927, 687,875 shares in 1926, 506,915 shares in 1925 and 439,348 shares in 1924.

CONSOLIDATED BALANCE SHEET

As of December 31	1927	1926	1925	1924
Assets				
Plant and property	$34,008,606	$29,332,434	$23,951,618	$20,793,860
Contract advances	498,545	838,054	680,458	445,414
Investments	160,033	127,814	119,119	127,087
Deferred charges	639,367	463,956	238,682	162,341
Current Assets—				
Cash	1,333,346	1,123,704	899,270	1,277,287
Accounts and notes receivable	4,258,980	4,448,777	4,482,106	3,781,590
Government securities	6,100,350	5,647,006	6,515,129	4,551,928
Inventories	3,431,907	3,754,123	3,319,319	3,107,081
Total current assets	$15,124,583	$14,973,610	$15,215,824	$12,717,886
Total assets	$50,431,134	$45,735,868	$40,205,701	$34,246,590
Liabilities				
Preferred stock	$ 8,141,600	$ 8,441,600	$ 8,741,600	$ 9,032,900
Common stock	13,823,960	13,757,500	10,138,300	8,786,960
Res. for return of bags and continuing	1,593,114	1,663,049	1,654,800	1,563,222
Surplus	24,233,219	18,804,982	16,789,971	12,595,680
Current Liabilities—				
Accounts payable	924,426	1,210,554	1,183,038	1,126,980
Accruals	1,714,815	1,858,183	1,697,992	1,140,848
Total current liabilities	$ 2,639,242	$ 3,068,737	$ 2,881,030	$ 2,267,828
Total liabilities	$50,431,134	$45,735,868	$40,205,701	$34,246,590
Net working capital	$12,485,341	$11,904,873	$12,334,794	$10,450,058

Monolith Portland Report

MONOLITH Portland Cement Co. for year ended December 31 reports 1,445,794 bbl. of cement manufactured and shipped. Coy Burnett, president, in making his announcement, failed to comment on earnings for 1927, other than to say that after all charges average annual net profits for the last five years have exceeded $500,000, and that dividends paid since the company was organized in 1920 amount to more than was originally paid into the company. Orders since the first of this year are reported to be four times that of the corresponding period of last year.—*Wall Street News.*

Giant Portland Income Report

THE Giant Portland Cement Co. reports for the year ended December 31, 1927, net income of $205,894 after charges and taxes, equivalent after preferred dividends to $3.39 a share on the 22,108 shares (par $50) common shares outstanding. This compares with $493,736 or $16.40 a share on the common stock in the preceding year.

Sand-Lime Brick Association Meets in Washington, D. C.

Program Covers Many Current Problems Both Within and Without the Industry

AT the 24th annual convention of the Sand-Lime Brick Association, Washington, D. C., February 1 to 3, ***John L. Jackson,*** dean of the sand-lime brick industry in America, of Saginaw, Mich., was re-elected president. Other officers elected were: A. S. Robertson, Harbour Brick Co., Toronto, Ont., vice-president; Ellen Knight, Saginaw Brick Co., Saginaw, Mich., secretary; Allen G. Walton, Hummelstown Brownstone Co., Hummelstown, Penn., treasurer. The executive committee consists of C. H. Carmichael, American Brick Co., Boston, Mass.; R. C. Kiser, Crume Brick Co., Dayton, Ohio; Dr. A. S. Wolfe, National Brick Co., Washington, D. C.; Otto Schwartz, American Brick Co., New Orleans, La.; W. A. Smyth, York Sandstone Brick Co., Toronto, Ont.; J. G. Schluchter, Rochester Sand and Brick Co., Detroit, Mich.; E. W. Smythe, Wisconsin Brick Co., Madison, Wis.

In his message to the convention as president, Mr. Jackson particularly emphasized the need of an advertising campaign of national scope to promote the use of sand-lime brick, which are very popular in some localities like Detroit, but generally little known to architects and builders in most parts of the country. Most of the general publicity given sand-lime brick in recent years has been the result of the work of the Michigan producers, whose booklet, "Structures that Endure," has been widely used for educational purposes.

The business of the sand-lime brick industry in 1927, Mr. Jackson thought, was just as good as in 1926, although he had predicted a year ago that it would not be quite so good. His forecast for 1928 is that there will be at least as much building as in 1927.

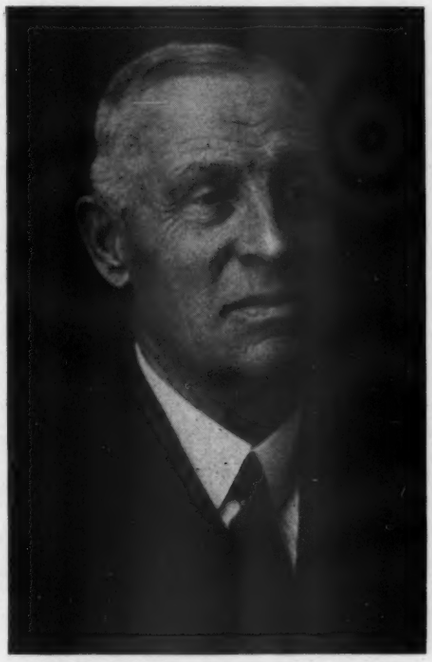
President Jackson mentioned the loss during the past year of two honorary members of the association, Ira H. Woolsen and Henry S. Spackman, and later in the sessions, on President Jackson's suggestion, appropriate resolutions were adopted.

The possibility of a research fellowship at the U. S. Bureau of Standards was again broached to the association, and was referred for future action to the technical advisory committee. President Jackson concluded his address with congratulations for the secretary and other officers of the association for their helpfulness and assistance.

The reports of the secretary and the treasurer showed that the association is accumulating a sizable surplus.

Clay Brick Competition

As usual, several evidences of the methods of competition adopted by clay brick manufacturers were in evidence. ***W. H. Crume,*** Crume Brick Co., Dayton, Ohio, called attention to a recent report of the Fire Underwriters giving ratings on common clay brick, and expressed the desirability of having sand-lime brick given an equivalent rating. Such a rating, he said, would be more useful than a national advertising campaign at this time, when sand-lime brick plants are relatively so few and scattered. To show the relative standing of sand-lime brick with common clay brick as a fire-resistant material, Mr. Crume quoted from Freitag's standard textbook on "Fire Prevention and Fire Protection" (published by John Wiley & Sons, New York City) a chapter on sand-lime brick by the late Ira H. Woolsen.



John L. Jackson, re-elected president, Sand-Lime Brick Association

Traffic and Freight Rates

J. Morley Zander, Saginaw Brick Co., Saginaw, Mich., reporting for the traffic committee, stated that several local actions had been taken on freight rate adjustments, but there had been no official appearances before railroad or commerce commissions. The railroads have been showing a co-operative spirit and the work of the committee has been largely advisory to various members of the association. In Michigan the railway authorities have accepted the principle that sand-lime brick is entitled to the same rate as common clay brick. Mr. Zander concluded his remarks by asking that the traffic committee be given funds for defensive measures, but not to attempt an aggressive action on the rate structure as a whole.

A. K. Walton, Hummelstown Brownstone Co., Hummelstown, Penn., said that he had had no great difficulty in persuading the Pennsylvania Public Utilities Commission that sand-lime brick is entitled to the same rate as common clay brick; he had merely to establish that sand-lime brick is used for the same purposes and sells at prices in competition with common clay brick. He used much of the data available from the Ohio and Indiana cases, data on products from the U. S. Census reports, technical data on methods of manufacture, etc. Four of the railways of the state immediately accepted the new rates, and no railway opposed their introduction.

Report of Educational Committee

J. M. Porter, U. S. Bureau of Standards, Washington, D. C., reported for the educational committee as follows:

"During the year two major items have received the attention of the committee, namely, more general acceptance of the definition of the word "brick" without reference to composition and the adherence of the sand-lime brick industry to the Department of Commerce's Simplified Practice Recommendation No. 38, 'Sand-Lime Brick.'

"Very little progress of a tangible nature can be reported concerning the first subject, but undoubtedly the term 'brick' now calls up in the minds of more people than ever before, products other than of a definite composition and it follows that brick made from sand and lime has received consideration regardless of whether or not the definition accepted by this association has been adopted. Individual and combined efforts in spreading the idea that brick is a building unit not of any specific composition will aid in obtaining the recognition which is due. The committee requests that each member bear this principle in mind in preparing advertising copy, in communications and in conversations.

"With reference to Simplified Practice

No. 38, the chairman of the committee, at the request of the Department of Commerce, forwarded 54 questionnaires relative to production and sizes from July 1, 1926, to December 31, 1927, to as many brick companies. The results to date of this survey indicate an adherence to the recommended sizes, 2½ by 3¾ by 8 in., of 77.6%. In 1925 the adherence was 61.5%.

"In view of these results the committee has adopted without a dissenting vote the following resolution:

"'A survey conducted by the chairman of the educational and standing committee on simplified practice of the Sand-Lime Brick Association covering the period from July 1, 1926, to December 31, 1927, having shown an increased adherence to Simplified Practice Recommendation No. 38 of the U. S. Department of Commerce over the period January 1 to June 30, 1926, it is recommended by the committee that Simplified Practice Recommendation No. 38 be reaffirmed in its present form to continue in effect and operation during 1928 and 1929, subject to revision at the 1930 convention of the Sand-Lime Brick Association based upon a proper survey of the industry by this or a similar committee.'"

Discussion of Standard Size Brick

W. H. Crume, who was one of the first to adopt the standard-size brick recommended by the Department of Commerce, said he had been forced to abandon it recently in favor of 2½-in. brick, to meet competition in his markets. The 2¼-in. brick meant about 10% increase in the number of brick required for a construction job, and contractors knew it; hence, as long as his common clay brick competitors made 2½-in. brick, he would have to do so. The cost of making the 2½-in. brick is about 25 cents per 1000 more than 2¼-in. brick.

Mr. Caldwell, representing the division of simplified practice of the U. S. Department of Commerce, said that there were a few competitive districts, including the southern Ohio and the Detroit sections, where competitive conditions kept alive the 2½-in. brick, but he believed eventually all would change to the 2¼-in. size—a matter of five or ten years, he thought.

Insurance

M. N. Brady, the Grande Brick Co., Grand Rapids, Mich., an insurance agent as well as a sand-lime brick manufacturer, had a paper, read by the president, on "Insurance from the Agent." He said that in the desire to cut overhead costs there is a great temptation to slight insurance. The desire for low insurance rates can only be met by a reduction in the hazards. He explained the scientific basis for fire insurance rates, upon well recognized hazards. Taking two typical sand-lime brick plants, he showed how the rates on one could be made very much lower than the rates on the other simply by having the plant gone over and inspected by an intelligent agent, so that common, neglected hazards could be eliminated and the rates correspondingly reduced. Insurance companies, he said, did not want high rates nor unnecessary hazards, and always are ready to co-operate to reduce hazards and rates.

C. H. Carmichael, American Brick Co., Boston, Mass., said the trouble with the insurance rate at many sand-lime brick operations is that they are classed with clay brick plants, while their hazards are not commensurate with clay manufacturing hazards. He said sand-lime brick plants are entitled to classification as "earth-working plants," which carries a lower rating.

T. C. Tayler, Sand-Lime Products Co., Detroit, Mich., said that in Michigan employes of sand-lime brick operations had been given a special classification under the state employer's liability laws.

Double-Brick and Hollow Tile

W. H. Crume described briefly his experiments to make hollow sand-lime tile. After several years experimenting he has come to the conclusion that there is no machinery on the market with which satisfactory tile can be made. From sand-lime hollow tile he has turned to cinder and slag concrete hollow tile, which he sells, when demanded, as a backing material for his sand-lime brick. He found both cinder and slag concrete tile unsatisfactory in a number of instances because of the sulphur in them, and the tendency to corrode nails driven into them. Recently he has been making double-size sand-lime brick for backing material, using a Blystone automatic hydraulic press, and these are moving quite satisfactorily.

Slag-Lime Brick

L. Haigh, W. A. Riddell Co., Bucyrus, Ohio, read a paper on "Tests of Slag for Slag-Lime Brick," which is reproduced herewith:

"The manufacture of slag-lime brick is, in the writer's opinion, so closely related to the manufacture of sand-lime brick, as the process is practically the same, that the writer of this paper decided to give you as much information on the tests made by him and his associates covering slag, or we should say slags from different steel mills in this country, as it is possible at this time to give.

"To commence, it would be well to state that the slag when first brought from the steel mill is not in proper condition for the manufacture of brick, as you know; we found that it contained too much moisture. Slag is of a very porous nature—in fact, it is very much like the honeycomb, and in these pores are drops of water which have to be removed before the slag can be manufactured into brick.

"In the last test made of slag, the writer found the moisture content of the slag to be 39% water. We tried before drying this slag to see what it would do, but when mixed with lime it just went into what you could term 'mush,' but when the slag was dried to contain only about 5% water we found that it was then as good as sand for the manufacture of sand-lime brick.

"Slag, as you know, is of a very bulky nature, but when ground down does not take up any more room than sand does in a sand-lime plant, but it must be dried in a rotary dryer, or some other equivalent dryer, before bricks can be made. This we have proven in our testing laboratory.

"This is all that need be said on the condition of the slag and the water contents in the slag as it comes from the steel plant.

"One of the tests we made was of slag from the Pittsburgh district, but the writer is not able to tell you from which mill this slag was sent to us, as it did not come to us direct from any steel mill, but we were advised by the party sending it to make as complete a test as possible.

"We first notified the parties that we would dry this slag as dry as possible, which we did, and then their representative came to Bucyrus and we made fifty-one bricks. The first batch of brick we put through, we ground the slag very fine, screened it through different mesh screens and found that through the No. 8 mesh screen the residue was 1.4%. The fineness of the slag is here given:

No. of screen mesh	Residue
8	1.4
10	2.3
14	2.5
20	6.3
28	9.9
35	29.6
48	5.7
65	17.2
100	10.6
Bottom	13.5
	99.0
	1.0 loss
	100.0

On the No. 2 sample slag the screening was as follows:

No. of screen mesh	Residue
8	.7
10	3.8
14	19.8
20	17.8
28	27.0
35	24.2
48	3.5
65	1.0
100	.8
Bottom	.8
	99.4
	0.6 loss
	100.0

"This second lot of slag we did not grind as fine, as you will notice that more material went through the No. 10, 14, 20 and 28 mesh screens, than had gone through the first lot; and the third batch of slag we ground just like the first.

"Referring now to the first lot of slag which we ground very fine as shown by the screening test, we made these brick on a vertical press, which as you know gives pressure both from upper and lower pressure plates, using 91% slag and 9% lime, and steamed them in the cylinder for ten hours at 100-lb. steam pressure, and the second

lot of slag, which was not ground as fine, we used 91% of slag and 9% of lime, and steamed them ten hours at 100-lb. steam pressure.

"On the third lot of slag ground fine like the No. 1, we used 90% of slag, 8% of lime and 2% of portland cement. The difference in the brick was not noticeable to the eye. The bricks were then packed and sent to a testing laboratory, and we found these results: The dimensions of the brick were all the same; the sectional area per square inch was the same, but the crushing strength was entirely different.

"On the No. 1 test the crushing load in pounds varied from 48,090 to 55,850 lb., or the crushing strength per square inch varied from 5228 to 6070 lb. per square inch. I wish to call your attention to this fact, that the lowest crushing strength per square inch was 5614 lb. on this test, and on the second, where the slag was not ground as fine, the crushing strength varied from 3342 to 4200 lb. per square inch, showing that the finely ground slag with the same percentage of lime and the same steam pressure for the same length of time, the bricks stood, on the average, 1966 lb. more crushing strength per square inch.

"On the absorption, we found that the finely ground slag had an absorption test of 8½%, where the coarser ground slag showed an absorption of 10½%, which proved to us that the finely ground slag with the largest crushing strength has the smallest absorption test. Let us refer now to the No. 3 test, which contained cement. The crushing strength was very similar to the No. 1—namely, the average was 5548 lb. per square inch, but the absorption test was 1½% lower, or only 7%.

"I do not wish to infer from this that it is advisable to mix in cement, but in the test made on this slag you will readily see that if absorption is a factor in the sale of sand-lime brick or slag-lime brick, a small proportion of cement may help out that difficulty.

"In conclusion, I would like to state that slag in the first place must be dried, even though you have to add water later to make the proper consistency of the material before it enters the press. In the second place, lime must be added in a proportion from 7% to 9% of the total product, and, third, slag-lime brick will not be made quite as cheaply as a sand-lime brick, due to the fact that the slag has to be dried before it can be used."

Discussion

In the discussion which followed, it was developed that 5% to 7% of water was used in the slag-lime brick mixture, added to the dried slag and lime. Granulated slag was used in all the tests, not air-cooled slag. Low pressure steaming tests were not successful. The brick were manufactured in a laboratory pressure cylinder, not on a commercial scale. No effect from the sulphur in the slag on the steam cylinder had been noted. Some of the slags made brick lighter than the average sand-lime brick, but most of the samples were of a darker shade.

Technical Problems

J. Morley Zander read a paper on "Technical Problems of the Sand-Lime Brick Industry Needing Attention," as follows:

"The technical problems of making sand-lime brick are both chemical and mechanical. The combination of calcium oxide, water and sand may be effected in several ways and the resultant brick pass the requirements of a good building material.

"Lime is received either as lump, crushed or finely pulverized calcium oxide, or as calcium hydroxide. If it is calcium oxide it must be hydrated. This may be done before mixing with the sand, or, if finely pulverized, the hydrating may be accomplished while and after mixing with the sand. Brick are produced by both methods and with variations of both methods.

"Study both in the laboratory and in operating plants of these different ways of handling and combining sand, lime and water might work to the economic advantage of the industry.

"Possibly a new method of hydrating and combining the essential materials of our industry might be developed. Could the sand, lime and water be definitely determined by passing these essential materials through accurate measuring machinery and eliminating the human element, it would be a big step forward. The lime manufacturers can generally be relied upon to furnish lime of a definite analysis, but the sand used is mostly produced by brick makers for their own use. The Bureau of Standards has done much work in the past to determine the effects of sands on the making of brick. Would it improve the general standard of sand-lime brick if each manufacturer were to check up his sand supply with the Bureau's work and screen, wash, crush and otherwise prepare it? Sometimes necessity has forced a manufacturer to do this very thing.

"Apparently the solubility of the silica in the sand affects the quality of the finished brick, the time required for steaming and, of course, the cost of production. Some investigating might probably be done along this line.

"One question leads to another. Would more thorough mixing cut costs and improve the quality? Can material be mixed too much? There are wonderful measuring and mixing machines built by experienced sand-lime brick machinery makers—have they reached the limit, or can they go further producing for us more accurate measuring, better grinding and mixing machines to the improvement of the finished brick?

"The questions put as to the mechanical side of our business will be solved by the machine makers and their engineers as soon as we demand it. But we must know what to ask for, must know what we want to do. Much laboratory and field work must be done by trained investigators. The good work done by the Bureau of Standards and the work it is now doing can be assisted by this association helping to secure the help required for additional and direct service. The members of this association can use the knowledge so acquired to make an even better brick than is now generally made. This better brick can be trade-marked and only those brick which conform to the standard set may use the trade-mark. It can be advertised and the public will come to know how good a brick the trade-mark means. In this way we can tie the work of the Bureau of Standards and our own experience to produce a still better product than we now make."

Advantages and Disadvantages of Foreign-Made Equipment

C. H. Carmichael read the following paper:

"A quarter of a century ago our president learned of a new commodity called Kalksandstein, which was being manufactured commercially at that time in Germany. He sensed the possibilities of this product and sailed immediately for Germany. After giving careful consideration to the various processes in use at that time he was able to arrive at certain definite conclusions. He returned to America bringing with him machinery and visions of untold possibilities.

"Today there is not a manufacturer of sand-lime brick in America who has not felt the influence of that voyage. His perception was keen and his ability to diagnose the frailties of this foreign-bought equipment prevented the discontinuance of his efforts. He immediately started to rebuild this equipment and, through his energy and efficiency, he has developed not only a substantial line of sand-lime brick machinery but has helped to develop what has now become a well balanced, successful and important national industry. Thus the *advantages of foreign equipment*, in this respect, were due mostly to the ideas involved in the process rather than in the commercial possibilities of the machines.

"Since then twenty-five years have elapsed. The evolution of our industry has brought about many important changes—new methods, new machines and new policies have come to us with startling rapidity. It is foolish for us to think that this same trend has not so continued in the various countries of Europe. If they have progressed more rapidly than we have, then it is up to us to learn from them. It is, at least, for us to consider their advancements and embody their worth-while developments in our own processes.

"At the end of the war, industry abroad was in a chaotic condition. It became necessary, for their very existence, that they begin production at once. In order to secure a world market it was essential that they produce their wares efficiently and at a low cost. This they did while we at home were enjoying a prosperous condition under entirely different circumstances. We were paying gladly unheard-of wages. Prices were

up and the demand for our products good. On account of this variance of conditions at home and abroad our manufacturers found they were unable to compete with foreign equipment on a price basis. Herein lies the one definite advantage in purchasing foreign equipment. We have all learned, by costly experience, that the initial cost of any commodity is far from being the concluding point in its purchase.

"Had I been asked a year ago to talk on this subject, I should have felt justified in elaborating to quite some extent on the advantages of certain foreign equipment. Today I hesitate to draw any definite conclusions, since it is still a much mooted question in our own mind. I therefore offer, for your information, certain facts which would be worth consideration should you at any time be faced with the selection of such equipment.

"At the present time we are operating three machines of foreign make. We purchased these only after thorough investigation of all competitive types brought to our attention. We do not regret their installation, but we soon found it necessary to temper our enthusiasm with cold reasoning. Certain *disadvantages* came to light which well warrant discussion.

Experience with Foreign Machinery

"The first machine installed was purchased in England. Our reason for going abroad for this machine was that we could not locate one in this country suitable for our peculiar requirements. After this machine had been in use for some weeks certain weak spots developed. We were at a distinct *disadvantage* because we were so far from our source of supply and unable to discuss quickly with the manufacturers the best method to overcome the difficulty. We were fortunate, however, in being located near a machine shop where competent engineers are constantly developing new machines. With their help the machine was redesigned and this trouble eliminated at considerable expense. We now felt that we would experience no more difficulty with this machine, but, to our chagrin, we were notified by an attorney that we were using a machine which he claimed was a direct infringement upon an American patent owned by an American firm. Had we purchased this machine in America this would probably not have occurred and we would have been spared considerable expense. Thus, in the case of this machine, the *disadvantages outweigh the advantages.*

"Our second experience with foreign equipment required considerably more thought. This machine was being offered us in direct competition with others of American make. We were able to observe one of these machines in operation and study its design and action. We were very favorably impressed by certain new developments involved in its construction, as well as by the sturdiness of its structure. We were also impressed by the apparent thoroughness of the workmanship. It looked like a real outfit. The price was roughly 20% less than other quotations.

"We ordered this machine and, after it had been installed but a few months, we placed an order for another. We specified that this machine was to be built, in every detail, similar to the one of prior order. When this machine was being installed we found that it would be practically impossible to exchange a part of one machine for a part of the other. It seems that each was built individually and fitted only to its own sphere of action without due regard to any form of standardization. This led to a serious complication in stocking repair parts. In order to overcome this difficulty we have found it necessary to redesign certain parts of each machine. We now have the most important parts of these machines standardized so that a single repair part may be used on either machine. This type of work, as you know, is very costly and must be taken into consideration with the purchase price in fairness to American manufacturers.

"Another *disadvantage* is in the fact that this machine is built on the metric system. This fact complicates matters to a considerable extent, since very few of our machine shops are equipped with tools to reproduce easily the dimensions required.

"As a summary I would name the chief *advantage of foreign equipment* as follows: Low initial cost, solidity of structure, excellence of design that protects important wearing parts, and the value that may be obtained from the study of such machines.

The *disadvantages:* Lack of standardization, use of the metric system, distance from source of supply, inconvenience of transoceanic shipments, including customs, exchange and possible litigation, possible misinterpretation of communications, liability of infringement. Lastly, the lack of personal contact with the producer, which prevents co-operative action to bring about advantageous changes which might enhance the value of the equipment.

Proposed Specifications

W. H. Crume, reporting for the committee of the American Society for Testing Materials on specifications for common brick, said that the clay brick manufacturers had at last succeeded in getting specifications for common clay brick separate and distinct from sand-lime brick and concrete brick. This left sand-lime brick undefined by the A. S. T. M., and it is important to get some specifications before that society for action. Tentative standards, to be submitted to the next meeting of the A. S. T. M., he read as follows:

Classification, Physical Properties, and Tests

"1. These specifications cover brick made from sand and lime, intended for use in brick masonry.

"2. (a) The bricks shall be classified as HARD, MEDIUM and SOFT on the basis of the following requirements. The classification of any lot of brick shall be determined by the results of the tests for that requirement in which it is lowest.

	Percentage Absorption		Modulus of Rupture (Bricks flatwise, 7-in. span, lb. sq. in.)	
	Mean of 5 tests	Individual Maximum	Mean of 5 tests	Individual Minimum
Hard	12 or less	15	600 or over	400
Medium	10 to 20	24	450 or over	300
Soft	20 or over	No limit	300 or over	200

"(b) The above tests shall be conducted in accordance with the Tentative Methods of Testing Brick (Serial Designation, C-67-27T) of the American Society for Testing Materials.

"3. For the purpose of tests, bricks representative of the commercial product shall be selected by a competent person appointed by the purchaser, the place or places of selection to be designated when the purchase order is placed. The manufacturer or seller shall furnish specimens for test without charge. All bricks shall be carefully examined and their condition noted before testing. For the purpose of tests not less than ten bricks shall be required. In general, two samples of ten bricks each shall be tested for every 100,000 bricks contained in the lot under consideration; but where the total quantity exceeds 500,000, the number of samples tested may be fewer, provided that they shall be distributed as uniformly as practicable over the entire lot. Additional representative samples may be taken at any time or place at the discretion of the purchaser.

Standard Size

Standard Size

"4. The standard size of sand-lime brick shall be 2¼ by 3¾ by 8 in., with permissible variations of plus or minus 1/16 in. in breadth and depth and plus or minus ⅛ in. in length.

Inspection and Rejection

Visual Inspection

"5. All bricks shall comply with the following requirements for general properties under visual inspection:

"(a) They shall be sound, of compact structure, reasonably uniform in shape and free from cracks, warpage, large pebbles, balls of clay, or particles of lime that would affect their serviceability or strength. After subjection to absorption test they shall show no superficial disintegration.

"6. If the visual inspection, Section 5, appears to indicate inferior strength, the brick may be rejected unless the physical tests show the quality or grade to be as specified."

These specifications, Mr. Crume said, differed from the Master Specifications for Sand-Lime Brick, of the U. S. Government (published in Rock Products, February 18, 1928) chiefly in the absorption test. They are practically identical with the specifications for common clay brick except for the material of which the brick are made, and excepting this particular sand-lime brick will fill every requirement for common clay brick.

I. G. Toepfer, at this point, called attention to the possibility of greatly improving

sand-lime brick by washing the sand.

Sessions at the Bureau of Standards

Two sessions of the convention were held at the Bureau of Standards. The convention there was welcomed by ***Dr. G. K. Burgess,*** director, who explained in a general way the purpose and work of the Bureau.

P. H. Bates, chief, clay and silicate products division, Bureau of Standards, gave a most interesting and instructive "blackboard" talk on the chemistry of the calcium silicates. He began by stating that silicon, the metal element (Si) in silica (SiO_2) is the second commonest chemical in nature. Its activities and combinations closely parallel those of the element carbon (C); but, while carbon has been the subject of a vast amount of research, and many volumes have been written about the chemistry of carbon, there does not exist any record of similar research in silicon.

Silica is one of the principal components in portland cement, sand-lime brick and many other materials of commercial importance, yet very little is known, and what is known is little utilized. There are eight different forms of silica. All can be readily prepared in the laboratory; three forms occur in nature. At varous stages of heat silica undergoes transformations which give the material vastly different properties. The possibility of converting the silica from one form to another for its use in the arts seems never to have been practiced, although advantage has been taken of some of the forms, such as flint, to make materials of commerce, which cannot be made with other forms of silica.

Mr. Bates went rather hurriedly through the various useful silicates, of which window glass and portland cement are the two most known examples. The silicates found in nature are not of the simple type, and the simple silicates are not stable. He does not consider the silicates in portland cement stable, if stability is measured in terms of a thousand years or more. The simple calcium silicate ($CaO \cdot SiO_2$) goes through a series of changes similar to silica, at various degrees of heat. Emphasizing the importance of the silicates, Mr. Bates said 50% of portland cement was di-calcium silicate ($2CaO \cdot SiO_2$) and from 25% to 50% tricalcium silicate ($3CaO \cdot SiO_2$). To convert portland cement to 100% $3CaO \cdot SiO_2$ by any known process at the present time would make it worth its weight in gold, he said.

Stanton Walker, director, engineering and research division, National Sand and Gravel Association, presented an excellent summary of modern methods of winning and preparing commercial sand and gravel, touching on the great opportunities which exist for research work on sand for various purposes, including sand for sand-lime brick.

Warren E. Emley, who did a great deal to establish technical literature in the sand-lime brick industry, in years gone by, and who is now chief of the organic and fibrous materials division of the Bureau of Standards, described the accomplishments of his division in researches on rubber, textiles, paper, leather, corn stalks, cotton seed, and similar waste materials. He painted a glowing picture of the future of these materials.

Mississippi Flood Prevention

Maj.-Gen. Edgar Jadwin, Chief of Engineers, U. S. A., gave a very interesting and instructive, though brief, description of the Mississippi river problem and the various factors in the flood prevention program now before Congress.

J. W. Ginder, of the supervising architect's office, U. S. Treasury Department, spoke briefly on the status of sand-lime brick in the government's building program.

Luncheon was served to the members of the convention at the Bureau of Standards through the courtesy of Dr. A. S. Wolfe.

Importation of Sand-Lime Brick

President Jackson brought up the question of the importation of sand-lime brick.

L. Robbins, Paramount Brick Co., Brooklyn, N. Y., said he did not have any difficulty from competition with imported sand-lime brick.

It was reported that there is still a large quantity of imported sand-lime brick at Tampa, Fla., which have not been disposed of in several years.

The consensus of opinion was that this situation is curing itself through rising wages in Europe and lowering prices in this country.

Registration

C. W. Cadwell, Lakeland Silex Brick Co., Lakeland, Fla.; C. H. Carmichael, American Brick Co., Boston, Mass.; E. D. Church, Jackson and Church Co., Saginaw, Mich.; A. H. Clark, Jackson Brick Co., Jackson, Mich.; Wm. H. Crume, Crume Brick Co., Dayton, Ohio; Wm. F. C. Dall, Northern Indiana Brick Co., Mishawaka, Ind.; C. C. Dalley, National Brick Co., Washington, D. C.; W. W. Dohany, Michigan Sand-Lime Brick Association, Detroit, Mich.; Conrad Fern, Saginaw Brick Co., Saginaw, Mich.; J. Finkbeiner, Michigan Pressed Brick Co., Detroit, Mich.; C. F. Frank, Walker and Frank, Detroit, Mich.; D. M. Gray, Louisville Cement Co., Louisville, Ky.; L. Haigh, W. A. Riddell Co., Bucyrus, Ohio; F. L. Hubbard, Michigan Pressed Brick Co., Detroit, Mich.; Wm. F. Irwin, Jr., Louisville Cement Co., Louisville, Ky.; John L. Jackson, Saginaw Brick Co., Saginaw, Mich.; J. R. Kauffman, Crume Brick Co., Dayton, Ohio; T. A. King, The Grande Brick Co., Grand Rapids, Mich.; R. C. Kiser, Crume Brick Co., Dayton, Ohio; R. S. Lackey, Alleghany Slag Products Co., Buena Vista, Va.; N. S. Meyers, Menominee Brick Co., Menominee, Mich.; G. H. Nichols, The Grande Brick Co., Grand Rapids, Mich.; G. W. Phelps, Flint Sandstone Brick Co., Flint, Mich.; J. M. Porter, Bureau of Standards, Washington, D. C.; E. C. Powers, The Marble Cliff Quarries Co., Columbus, Ohio; L. Robbins, Paramount Brick Works, Brooklyn, N. Y.; A. S. Robertson, Harbour Brick Co., Toronto, Ont., Can.; N. C. Rockwood, Rock Products, Chicago, Ill.; J. G. Schluchter, Rochester Sand and Brick Co., Detroit, Mich.; E. W. Smythe, Wisconsin Brick Co., Madison, Wis.; W. A. Smyth, York Sandstone Brick Co., Ltd., Toronto, Ont., Can.; T. C. Tayler, Sand Lime Products Co., Detroit, Mich.; I. G. Toepfer, Acme Brick Co., Milwaukee, Wis.; Allen G. Walton, Hummelstown Brownstone Co., Hummelstown, Penn.; A. K. Walton, Hummelstown Brownstone Co., Hummelstown, Penn.; C. W. Wendt, Acme Brick Co., Milwaukee, Wis.; Dr. A. S. Wolfe, National Brick Co., Washington, D. C.; C. C. Wright, Lakeland Silex Brick Co., Lakeland, Fla.; J. M. Zander, Saginaw Brick Co., Saginaw, Mich.

Poisson's Ratio and Elasticity Modulus of Sand-Lime Brick

SOME RECENT work on sand-lime brick at the Bureau of Standards has consisted in testing this product for stress-strain relationships. The loads were applied by a 20,000-lb. testing machine, while the strains were determined by the use of Tuckerman optical strain gages. The latter gave most excellent results, and furnished a very accurate picture of what occurred when the loading was increased or diminished. Incidentally, the results speak well for the uniformity of these bricks.

Twelve bricks were tested. Four were tested in tension, four in compression on end and four in compression edgewise. With the bricks tested on edge, the secant modulus of elasticity varied from an average value of about 1,700,000 lb./in.^{2} at no load to about 1,600,000 at a stress of 1000 lb./in.^{2}. For a second loading the modulus of elasticity was nearly constant throughout the loading and its average value was about 1,600,000 lb./in.^{2}. The modulus of elasticity in compression was about equal to the modulus in tension.

For the modulus of elasticity determinations, readings of strain were obtained on two gages attached at the center of the length on opposite sides of the brick. It was found that with a slightly eccentric loading in compression the readings for the two gages were unequal, but the averages were approximately the same as for concentric loading.

Both the longitudinal strains (in the direction of the loading) and the transverse strains (at right angles with the direction of the loading) were determined on one brick. From these strains the value of Poisson's ratio (the ratio of the transverse to the longitudinal strain) was found to be one-seventh throughout loading range.

Three bricks were tested for changes in strain while being loaded transversely; that is, in bending. The supporting knife-edges were 7 in. apart and the load was applied on top at the center of the span. A notch was cut in the upper knife-edge so that it could straddle the gage. To insure pressure directly under the gage, as well as elsewhere, a steel strip extended across the brick under the gage and under the knife-edge so that the load would be distributed properly. There was close agreement between the compression of the upper side and the elongation of the lower side, these relations holding also when the brick was turned and tested again.—*Technical News Bulletin.*

U. S. Government Specifications for Common Sand-Lime Brick

I. General Specifications

THERE are no general specifications applicable to this specification.

II. Classes

This specification is applicable to common (not face) sand-lime brick of any of the following three classes: H, hard; M, medium; S, soft.

III. Material and Workmanship

Brick under this specification shall be of sand and lime hardened by treatment with high-pressure steam. They shall be sound, of compact structure, reasonably uniform in shape and reasonably free from lime spots, large pebbles and balls of clay.

IV. General Requirements

The standard size of brick shall be 2¼x 3¾x8 in., with permissible variations of ⅛ in. in breadth or depth and ¼ in. in length.

Bricks shall be delivered in good conditions, with not more than 5% of broken bricks.

At the completion of the absorption test the bricks shall show no evidence of a tendency to disintegrate.

V. Detail Requirements

The bricks shall meet the following absorption and strength requirements for their respective class. The standing of any set of bricks shall be determined by the requirements in which it is lowest. Unless otherwise specified in the request for bids, medium (M) or hard (H) brick shall be accepted in lieu of soft (S) brick and hard (H) brick in lieu of medium (M) brick:

Class	Absorption average of five	Transverse breaking load. 7-in. span, average of five	Individual (maximum) Per cent	Individual (minimum) Pounds
H	12 or less	1,080 or more	24	725
M	12 to 20	810 or more	No limit	540
S	20 or more.	540 or more	15	360

VI. Method of Sampling and Tests

1. Sampling. Ten bricks selected by the inspector, so as to be fairly representative of a quantity not exceeding 50,000 bricks, shall constitute a sample. If the bricks are delivered by car or boat, one sample shall be taken from each carload or boatload. If the bricks are delivered by truck or wagon, one or more samples shall be taken at the point of origin covering all of the material from which shipments are to be made. Additional representative samples may be taken at any time or place at the discretion of the inspector.

1. Tests. The sample shall be dried to constant weight at a temperature of 212 to 220 deg. F.

(*a*) *Absorption.* When cool, 5 of the 10 bricks in the sample shall be weighed separately on scales sensitive to within ½ of 1% of the weight. They shall then be completely immersed in soft, distilled or rain water at room temperature. The water shall be brought to a boil within 1 hr. and boiling continued for 5 hr. The bricks shall be allowed to cool to room temperature in the water. They shall then be removed from the water and weighed, after wiping the surface with a damp cloth. This weight, minus the weight of the dry bricks, equals the weight of the water absorbed, which is calculated to per cent of the weight of the dry bricks.

Where means are not available for boiling the bricks, the absorption test may be made by immersing the dry bricks in soft, distilled or rain water at ordinary temperature for 5 hr. When this method is used, the required absorption limits for the different classes shall be reduced one-fourth below the values given in Section V for both the average and the individual maximums.

In cases of disagreement as to the resulting classification, the absorption shall be determined by the boiling method and the full percentage absorption for the respective classes given in Section V applied. The same bricks, redried to constant weight, may be used in any such retest.

(*b*) *Transverse Strength.* The other five bricks of the sample, previously dried, shall be tested laid flatwise on a span of 7 in. and with the load applied at the mid-point of the span with a standard testing machine or a calibrated portable or semi-portable testing equipment. A steel bearing plate about ¼ in. thick by 1½ in. wide shall be placed between the upper knife-edge and the brick. The knife-edges in contact with the brick shall be mounted so they will adjust themselves to the irregularities in the shape of the brick, and one or both of the lower bearings shall be free to follow any movement of the brick during the test.

VII. Packing and Marking of Shipments

No requirements.

VIII. Notes

1. *Strength Tests.* The acceptance procedure has been simplified to permit making the necesasry tests at the building site or at the manufacturer's plant without the use of laboratory equipment, although the latter should be used where available. Responsibility for the accuracy, calibration and general sufficiency of the equipment used necessarily devolves on the purchasing or inspecting officer concerned. The following specification is suggested for portable or semi-portable equipment for conducting the transverse test:

Portable or semi-portable equipment for conducting transverse tests of building brick shall be capable of applying a center load of not less than 4000 lb. on bricks laid flatwise on a span of 7-in. A steel bearing plate about ¼ in. thick by 1½ in. wide shall be placed between the upper knife-edge and the brick. The knife-edges in contact with the brick shall be mounted so they will adjust themselves to the irregularities in the shape of the brick, and one or both of the lower bearings shall be free to follow any movement of the brick during the test.

The equipment shall be constructed so it can be calibrated in a standard testing machine and shall accommodate bricks having ½ in. variation above or below the standard 2¼ in. thickness and 3¾ in. width. It shall be constructed so the load can be applied by hand with a maximum force of 50 lb. The parts shall be designed so as not to be readily damaged or displaced by shipment or handling, and have a suitable carrying case.

The weight of the portable equipment, inclusive of carrying case, shall be not more than 55 lb., and the accuracy and sensitiveness shall be within 30 lb. up to 2000 lb. applied load and within 60 lb. for higher loads.

The weight of the semi-portable equipment, inclusive of carrying case, shall be not more than 110 lb., and the accuracy and sensitiveness shall be within 10 lb. up to 2000 lb. applied load and within 20 lb. for higher loads.

The following manufacturers have, up to the date of issue of these specifications, indicated willingness to supply portable or semi-portable equipment complying with the above specifications:

A. H. Emory Co., Stamford, Conn.

Morehouse Machine Co., York, Penn.

Riehle Bros. Testing Machine Co., Philadelphia, Penn.

Tinius Olsen Testing Machine Co., Philadelphia, Penn.

2. *Significance of the Brick Classification.* The classification is based on strength and absorption values chosen, so that generally bricks grading as medium or harder can be considered suitable for use in exterior walls. This should not be taken as a rigid distinction on account of the wide range in the character of materials used in brick manufacture, which makes it difficult to define weathering resistance in terms of properties that can be determined in acceptance tests. The purchasing officer should be guided in part by the experience with comparable bricks in the locality where those under test are to be used. In cases of doubt and where the time and equipment are available, acceptance in point of weathering resistance can be based on ability to withstand 100 alternations of freezing and thawing conducted according to generally accepted laboratory procedure. Failure is to be considered as reached when the samples are cracked or show superficial disintegration or spalling, with loss of weight of more than 5% of the initial dry weight.

Where the wall is faced with 3 in. or more of stone, terra cotta, brick or other veneer, the weathering resistance of the material for the backing is without significance.

Sand-Lime Brick Production and Shipments in January

THE following data are compiled from reports received direct from 23 producers of sand-lime brick located in various parts of the United States and Canada. The number of plants reporting is 2 less than those furnishing statistics for the December estimate published in the January 21 issue. The statistics below may be regarded as representative of the entire industry, the reporting plants having about one-half the production capacity in the United States and Canada.

Production showed some continued decrease from the figures for December and the preceding months, as is to be expected at this season. Four plants reported no production, as against seven in December. Slight decreases were also shown in both truck and rail shipments, and in unfilled orders, while a greater decrease was noted in the stocks on hand. Prices quoted by dealers are stationary over practically the whole country.

The following are average prices quoted for sand-lime brick in January:

Average Prices for January

Shipping Point	Plant Price	Delivered
Albany, Ga.	$10.00	.....
Atlantic City, N. J.	14.00	.....
Buffalo, N. Y.	12.25	$16.50
Dayton, Ohio	12.50	15.00
Detroit, Mich.	13.50	16.00
Detroit, Mich.	12.50	15.50
Detroit, Mich.	.....	16.00
Flint, Mich.	11.00	.....
Grand Rapids, Mich.	12.50	.....
Jackson, Mich.	12.25	.....
Madison, Wis.	11.00	.....
Menominee, Mich.	11.00	14.50
Michigan City, Ind.	11.00	.....
Minneapolis, Minn.	10.00	12.75
Plant City, Fla.	.....	.....
Pontiac, Mich.	12.50	16.00
Rochester, N. Y.	.....	19.75
Sebewaing, Mich.	.....	.....
Sioux Falls, S. D.	13.00	13.00@16.00
Syracuse, N. Y.	18.00	20.00
Toronto, Canada	13.50	16.00
Toronto, Canada	12.20	15.70
Winchester, Mass.	.....	16.00

The following statistics are compiled from data received direct from 23 producers of sand-lime brick in the United States and Canada:

Statistics for December, 1927, and January, 1928

	*December	†January
Production	13,912,100	10,651,800
Shipments (rail)	4,188,600	3,307,000
Shipments (truck)	8,693,500	6,776,700
Stock	18,538,000	14,282,000
Unfilled orders	14,772,000	10,830,000

*25 plants reporting.
†Incomplete, five plants not reporting stocks and seven plants not reporting unfilled orders.

Notes From Producers

The new plant of the Atlas White Brick Co., Atlantic City, N. J., at Berlin, N. J., has been put into complete operation and the company's old plant at Penbryn is permanently closed and the machinery has been removed.

Mount Lime Co. Chartered in Lynchburg, Va.

A CHARTER for the Mount Lime and Chemical Corp., Lynchburg, Va., has been issued and financing of the company is now being carried out, according to information from the office of W. D. Mount, chemical engineer of Lynchburg. The proposed capitalization is $500,000. The principal product of the new company will be high grade lime for the use of the chemical industries. A line of lime products and by-products will also be developed.

The Mount company has purchased property on which it will establish its plant about eight miles east of Natural Bridge, Va., on the Chesapeake and Ohio railroad. The plant will be of steel construction throughout, and will include four gas-fired kilns, a hydrating plant and chemical laboratories. The quarry will be located about a mile from the plant and will be connected to it by an aerial tramway. The work of designing and supervising the construction of the plant will be under the personal direction of Mr. Mount, who will also operate it upon completion of the work.—*Lynchburg* (Va.) *Advance.*

L. G. Everist, Inc. to Open New Gravel Plant in Iowa

INCREASED demand for properly washed and prepared sizes of sand and gravel for concrete construction in the Sioux City, Iowa, territory has caused L. G. Everist, Inc., of Sioux City, to open a new source of supply near Hawarden, Iowa. The new plant will be of all-steel construction and will have a capacity of 2000 tons of washed and screened gravel per day. It is expected that the new plant will be ready for operation about the first of April.

A large acreage has been obtained near Hawarden, and this will be worked by a 5-ton dragline, loading into 7-yd. standard gage dump cars. A steam locomotive will be used to haul the cars to the plant. The plant will be equipped with crushers and scrubbers, and will be electrically operated throughout. There will be ample space for 30,000 tons yard storage beside the bin storage. The track layout has been specially designed for easy and quick handling of cars.—*Sioux City* (Iowa) *Journal.*

U. S. Gypsum Disposes of Last Retail Establishment

THE liquidation of the retail building supply business which the United States Gypsum Co. of Chicago operated in Buffalo, N. Y., was recently announced by that company. This marks the disposal of the last of the retail businesses which the U. S. Gypsum Co. owned or operated. Previous to this sale the company disposed of similar retail establishments in Hartford, Conn., and Boston, Mass.

Indiana Portland Installs Fourth Kiln

THE Indiana Portland Cement Co. of Indianapolis, Ind., a subsidiary of the International Cement Corp., has recently completed the installation of a fourth kiln at its plant at Limedale. The new kiln will have a capacity of 1500 bbl. a day, which will bring the total capacity of the plant to approximately 6000 bbl. per day. The kiln was fired for the first time on January 28.—*Greencastle* (Ind.) *Herald.*

Producers Protest Proposed Kentucky Tax on Ohio River Sand

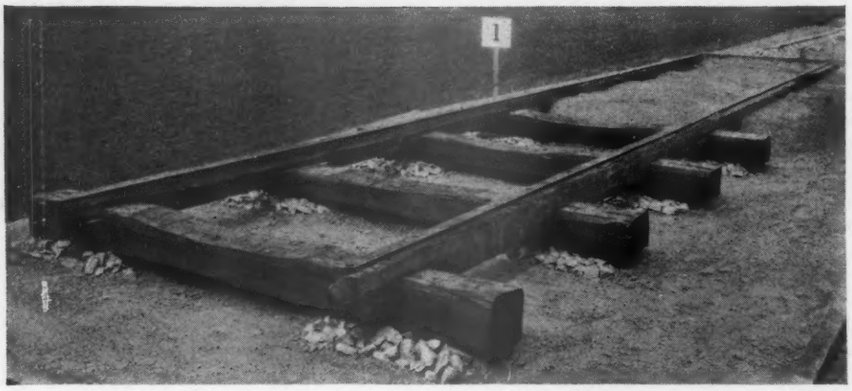
A PROTEST will be made by sand and gravel producers to Governor Sampson, newly elected executive of Kentucky, against the passage of a bill by the state legislature which would place a tax on sand and gravel taken from the Ohio river, according to a recent announcement. The proposed bill would levy a tax of 10 to 14 cents on every yard of gravel removed from the river where it touches Kentucky, the revenue thus obtained to be used for the purchase of free textbooks for the schools of the state. Since more than 600,000 tons of material is taken from the river during each summer month, the proposed tax would be a source of considerable revenue to the state.

A committee has been appointed by the Kentucky Association of Sand and Gravel Producers to formulate the protest to the governor. E. T. Slider is chairman, and the others on the committee are Fred Hall, of Fort Thomas, president of the association; H. P. Caldwell, of the Ohio River Sand and Gravel Co.; P. A. Yaeger, Owensboro, and E. V. Brown, of Huntington, W. Va. A delegation recently called on Governor Sampson to discuss the proposed gravel tax and after the meeting the governor asked for additional information, which will be furnished by the committee. The producers discussed the proposed levy recently at a meeting at the Kentucky hotel in Louisville which was attended by about 50 members of the association, representing towns along the Ohio river from Huntington, W. Va., to Cairo, Ill.

An interesting angle to the question is presented by the attitude of the state of Ohio, which has met the statement of the proposed Kentucky tax with a flat declaration from the Ohio Highway Department that Ohio would listen only to the federal government in regard to the sand and gravel which the state removes from the river. The highway department takes the position that, since the Ohio river is a navigable stream, and since the state of Ohio is making it more navigable, then the state of Kentucky would be without power to charge Ohio for the sand and gravel removed, or to compel the state to stop removing the material.—*Louisville* (Ky.) *Herald-Post.*

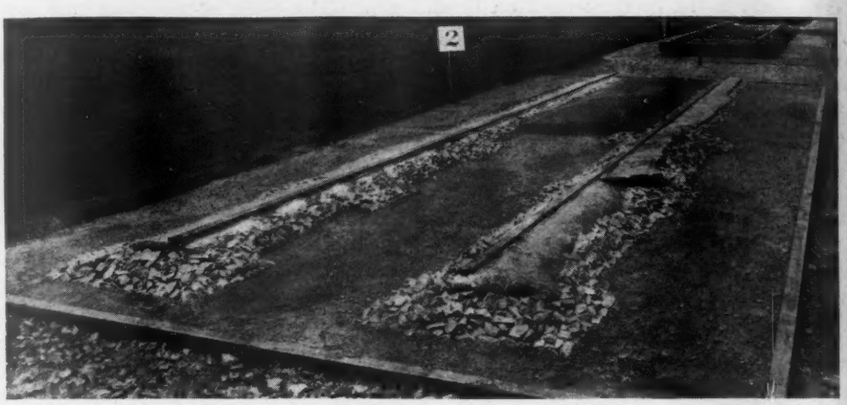
The Evolution of Track on

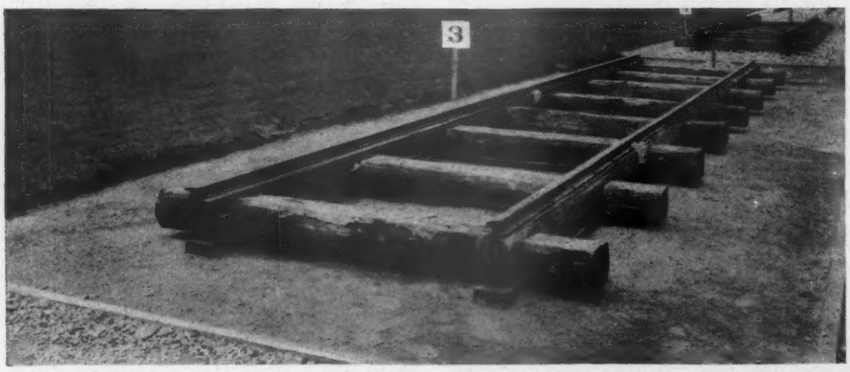
As Depicted in Exhibits Displayed at the Centenary Exhibit



Track No. 1 represents the first type of construction used in 1830 on the original main line between Baltimore, Md., and Ellicott Mills. This track was built of iron strap rails, about 2½ in. wide and ⅝ in. thick, spiked at about 18-in. intervals to 6-in. by 6-in. stringers which in turn were notched into the cross ties. The cross ties were spaced about 3½ to 4 ft. apart and secured to the wooden stringers by means of wooden wedges driven on the inner side of the mortise.

Track No. 2 represents the second type of construction used in 1830 on the original main line between Baltimore, Md., and Ellicott Mills. This type employed the same strap iron rails and spike fastenings as shown in Track No. 1, but with the rails supported on rough cut granite sills, which were about 12 in. to 18 in. across from top, 6 in. to 12 in. deep, and from 8 ft. to 10 ft. long. These sills were supported in a relatively thin layer of granite ballast.





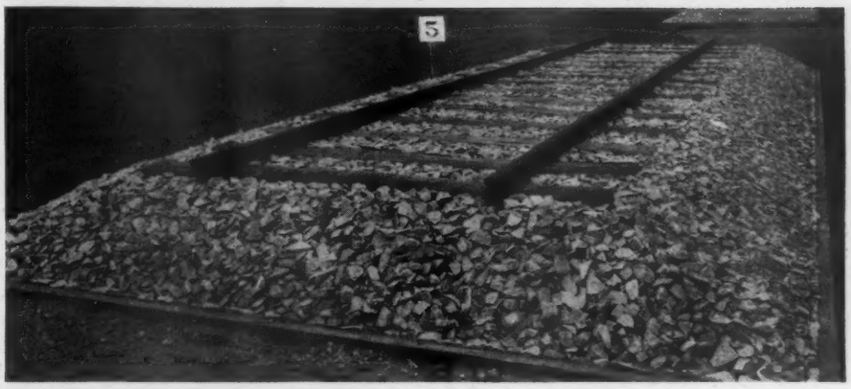
Track No. 3 illustrates the sill, tie, stringer and edge rail construction used in 1835 in the original main track between Relay, Md., and Washington, D. C. The bottom 6-in. by 6-in. sills, laid in a sandy ballast, supported 6-in. by 10-in. hand hewn ties which were notched to carry the 6-in. by 6-in. top stringers that supported the rails. This rail was the first step toward the pear-shaped and tee rails used later. It was furnished in lengths of about 15 ft. and weighed 40 lb. per yd.

Track No. 4 shows the type of construction used in 1842 on 96 miles of line between Harper's Ferry, W. Va., and Cumberland, Md. This track was essentially the same as that designated as No. 3, except that U-shaped rails were used, and the bottom sills were supported on stone ballast. The U-shaped rail used in this track was the first rail manufactured in any quantity in America. This rail, which was spiked to the stringers with light-weight hook spikes, came in 20-ft. lengths and weighed 51 lb. per yd.

(Reproduced by courtesy of "Railroad Engineering and Maintenance"—

on American Railways

Exhibition of the Baltimore & Ohio at Halethorpe, Md.



Track No. 5 represents the pear-shaped rail weighing 60 lb. per yard used in 1851 and 1852 in the original line between Cumberland, Md., and Wheeling, W. Va. This rail, which was made of iron, was spiked directly to cross ties laid in a deep bed of hand-knapped granite ballast. The rail was 3½ in. high and came in 20-ft. lengths. The rail joints were soft iron plates secured to the ties by four spikes.

Track No. 6 illustrates the type constructed in 1869 for the renewal of the older types. It is practically identical to that shown in the previous illustration except for the type of rail joint and the fact that the rail used was of steel instead of iron. This rail, which was pear-shaped, was rolled in England and was known as John Brown rail. Its weight was 60 lb. per yd. and it came in varying lengths up to about 30 ft. The joint consisted of wooden splice blocks bolted through the webs.

Track No. 7 is the oldest example on the Baltimore & Ohio in which rails of the modern T-section were used. It illustrates track laid in 1874 with rails weighing 67 lb. per yd. The joints consisted of angle bars and the rails were secured direct to the cross ties by cut spikes. Track Nos. 8 and 9 (not shown here) were examples of similar but heavier construction used in 1889 and 1908, in which the rail was 85-lb. and 100-lb. section respectively.

Track No. 10, the last one in the exhibit, represents the type of construction used today on the important main lines of the Baltimore & Ohio. It consists of 130-lb. R. E. section rail laid on creosoted ties. This standard was first used in 1921. The added feature in this construction is the tie plate which was illustrated in Track No. 9 with 100-lb. rail.

Note the gradual increase in the use of ballast—its continually increasing depth)

Foreign Abstracts and Patent Review

The Cement Plant at Cantin (Nord). The cement plant at Cantin is not a large plant, but, having been built in 1924, it contains only the most up-to-date equipment. It is owned by Poliet et Chausson and has operated since July, 1926. It is located on the canal de la Sensee, which is connected by canals with Paris and the port of Dunkerque. It also has a line of track connecting it with the Northern Railways (Chemins de fer du Nord).

Two Orenstein and Koppel steam shovels, the smaller one removing the overburden, while the larger one digs the chalk from a face of about 40 ft. high, 23 ft. of which is under water, are used in quarrying.

The wet process is used here. The slurry tanks, of reinforced concrete, are octagonal in shape, with an inscribed diameter of about 30 ft. The chalk and clay are agitated and discharged into centrifugal separators of the "Trix" type. From these the slurry passes to the ball mills of the two-compartment type, of which there are two, each 25 ft. long and 6 ft. 6 in. in dia.

A special installation is provided on a lower level for the preparation of substances used in the manufacture of "super-cements."

An F. L. Smidth Co. compressor furnishes the compressed air for the lifting of the slurry into the slurry silos of reinforced concrete of 1400 cu. ft. capacity each. The slurry taken from the bottom of the silos is pumped by a special pump to the top of the rotary kilns.

The plant operates two Smidth rotary kilns, 200 ft. long and 8 ft. in diameter, the latter being enlarged to 9 ft. 3 in. in the burning zone. The kilns revolve at a rate of one revolution per 90 seconds, and each kiln is direct driven by a 50-hp. motor at 720 r.p.m. and speed reducer.

The pulverized coal used as fuel is prepared in a "Pyrator" mill 28 ft. long and 6 ft. 6 in. in diameter, with a capacity of 6 tons of pulverized coal per hour, leaving a residue of not more than 90% on the 4900-mesh sieve. The kilns are equipped with two Babcock waste-heat boilers with Green super-heater and economizer. The heat recovered is considerable and the boilers are in continuous operation. Dust collecting chambers consisting of two vertical cylinders 22 ft. high and 16 ft. 5 in. in diameter are part of the installation.

The clinker is ground in two ball mills with four compartments with large, medium, small steel balls and cylpebs respectively. The mills are 40 ft. long and 6 ft. 6 in. in diameter.

The cement is stored in five silos, of which one has a capacity of 4500 tons and four a capacity of 900 tons each. Four Smidth "Exilor" sacking machines are being used, one machine filling barrels.

The power plant comprises two Babcock steam boilers for auxiliary purposes, in view of the heat recovered in the waste heat boiler installation. The power is furnished by two 2000-k.w. Sautter-Harle turbo-alternators.—*Rev. de Mat. de Constr.* (1927) 216, 289-99.

Quick-Hardening Agent for Cement. Konosuke Nakamura, Kenji Tamura, and Masamichi Nakahara. Japan 10,214, Sept. 15, 1926. Dilute sulphuric acid is added to sodium silicate so as to change its greater part to sodium sulphate which is then filtered away. A solution of sodium silicate rich in free silica thus obtained is used as a quick hardening agent of portland cement. *Ceramic Abstracts* (1927), 503.

Pseudo Pottery of Magnesia Cement. Otsusaburo Nakamura. Japan 10,055, Sept. 1, 1926. Mixture of magnesia and clay is kneaded with addition of magnesium chloride solution. Flower-pot, brazier, and similar ware are made of the plastic mass by means of a potter's wheel. *Ceramic Abstracts* (1927), 503.

Impermeable Acidproof Cement. Yoshitugu Yamamura. Japan 10,005, Aug. 27, 1926. An impermeable acidproof cement is prepared by compounding a powdered mixture of "Boshu-sand" (a tuff), talc, barite, gypsum, and urea with water glass, formalin, and water. *Ceramic Abstracts* (1927), 503.

Chemical Utilization of Gypsum. The only two successful processes for the chemical utilization of gypsum consist (1) in the manufacture of sulphuric acid by the contact process from the sulphur dioxide obtained when a mixture of gypsum, silica, alumina and coal is heated in a revolving cement furnace, the residual clinker being used for making cement, and (2) in passing ammonia and carbon dioxide into an aqueous suspension of powdered gypsum, the resultant products being calcium carbonate and ammonium sulphate. In presence of water, hemi-hydrated calcium sulphate and magnesium in about equimolecular proportions react at the ordinary temperature, a solution containing about 50 g. of magnesium sulphate per liter being obtained after 45 days. With dihydrated calcium sulphate the reaction is slower and the resulting magnesium sulphate solution contains only 30-35 g. of the salt per liter. Other uses for magnesium sulphate are being sought. *Gior. Chim. Ind. Appl.* (1927), 9, 405-10.

Gypsum in the Manufacture of Ammonium Sulphate. The dried and sieved gypsum (400 g.) containing 73.37% $CaSO_4$, 4.32% $CaCO_3$, and traces of alumina, iron, magnesia and silica, is mixed with 70 g. of clay (SiO_2 72.20%, Al_2O_3 13.05%), 350 c.c. of commercial ammonia (32% NH_3), and 600 c.c. of water in an autoclave, the mixture being well stirred and a current of carbon dioxide bubbled through. The maximum yield of ammonium sulphate (96.6%) is obtained after 40 min. treatment at the initial and final temperatures of 70 and 48 deg., respectively, under a pressure of 750 g. The ammonia is recoverable from the mother-liquor, and the filtered paste when heated at 1550-1600 deg. gives a useful clinker (SiO_2 23.59%, CaO 66.77%, Al_2O_3 4.28%, with traces of titanium, magnesium and iron). This procedure insures the complete reaction of the gypsum. *Comptes Rendues* (1927), 185, 1138-41.

Slate Admixture to Portland Cement Concrete. In the manufacture of cement mortar, etc., from 5% to 15% of fine slate powder replaces an equal amount of the inert material, the ingredients being mixed in the dry state and then with water to which has been added ¼% to ½% of sodium silicate. *British Patent No.* 279,355.

Artificial Stone. To 140 parts of pulverized micaceous schist, 60 parts of a pulverized mixture (85% magnesia plus 15% coloring matter) are added and the whole carefully mixed dry. An equal proportion of a 24 deg. Bé. $MgCl_2$ solution is added and the paste poured into forms and allowed to harden. *British Patent No.* 266,364.

Acid-Proof Cement. Barium sulphate or barium carbonate and the proper amounts of sand-clay are crushed, mixed and burned to a sintering stage. Reducing agents such as coke or coal may be added to the mix before sintering. The sintered barium cement is ground and treated with a sulphate solution to render the resultant product more resistant to water and acids. The set is regulated by the addition of raw ground gypsum in a manner similar to portland cement manufacture. *British Patent No.* 269,549.

Porous Gypsum Compounds. Natural gypsum rock containing limestone as an impurity or calcined gypsum to which a certain proportion of limestone has been added is treated with a dilute mineral acid. The acid liberates the CO_2 from the limestone, which is then trapped in the plaster mass as it sets to form a porous gypsum compound. *British Patent No.* 266,524.

Toughening Stone. Stone is heated to 250 deg. C. and then brought into contact with a bituminous mass at a lower temperature, so that a vacuum is produced in the pores of the stone, through which the bituminous mass is sucked up into the pores and

converts the stone to a hard and tough material. This material can be vulcanized by adding powdered bituminous sulphur and heating the mixture to the reaction temperature or by bringing the material into a sulphur bath heated to about 120 deg. C. so that the sulphur combines with the bituminous mass on the face of the stone. *British Patent No.* 271,722.

Method of Manufacturing a White Cement from Dolomite. The Dairen Dolomite Kogyo Co. Japan 8,802, May 21, 1926. Intimate mixture of powdered dolomite, powdered quartzite, aqueous solution of sodium silicate, and aqueous solution of aluminium silicate or aluminium sulphate is calcined at 1600 deg. C. and ground with water. *Ceramic Abstracts* (1927), 502.

Method of Manufacturing Floor and Wall Tile from Gypsum. Tatsujiro Fukaya. Japan 8,284, April 2, 1926. Anhydrous calcium sulphate obtained by heating gypsum at high temperatures is treated with an aqueous solution of zinc chromate and aluminium chromate. Then it is fired again. The product is ground with addition of lime, blast furnace slag, ammonium phosphate, and ammonium borate. Floor or wall tile is made of the plastic mass obtained by kneading the powder with water. *Ceramic Abstracts* (1927), 502.

Recent Process Patents

The following brief abstracts are of current process patents issued by the U. S. Patent Office, Washington, D. C. Complete copies may be obtained by sending 10c to the Superintendent of Documents, Government Printing Office, Washington, for each patent desired.

Colloidal Calcium Carbonate. Freshly prepared milk of lime of not less than 10 deg. Bé. is treated with CO_2 gas at a temperature not greater than 15 deg. C. and a protective colloid added to preserve the colloidal state of the precipitated calcium carbonate during consequent evaporation of excess water. *U. S. Patent No.* 1,654,099.

Edge Shaper for Wallboard. The edge of the board is reshaped or straightened by a shoe positioned at a proper position and placed at right angles to the surface of the board to bear against the edge. Another shoe is adapted to ride on the marginal position of the upper face of the board to keep it smooth and even. Adjustments are provided to vary the pressure of the shoes on the board. *J. J. Turner, U. S. Patent No.* 1,654,024.

Electric Furnace for Cement Manufacture. An electric furnace for melting or producing cement and other substances, in which the substance is melted or produced forms a resistance for the electric current, comprising solid metal electrodes having a large heat accumulating capacity in relation to the substance to be treated. *U. S. Patent No.* 1,656,510.

Waterproof Cement. Natural diatomaceous earth which already contains some bituminous or oily matter is crushed to ¼-in. mesh and ground with portland cement clinker. The oil-bearing material may be ground to 200-mesh and mixed with the ground portland cement. Oily or hydrocarbon material may be added to ordinary diatomaceous earth and the mixture ground and added to the portland cement as above. The preferred proportions range from one part waterproofing material to 10-20 parts of clinker or cement. The modifying agent used to retard or control the drying of the waterproofing composition may comprise chloride, fluoride, sulphate, etc., of calcium, magnesium or zinc in the proportions of one part agent to 10-100 parts of waterproofing composition. *H. V. Welch, U. S. Patent No.* 1,644,964.

Magnesium Metal from Dolomite. Dolomite is reduced to a comminuted condition and purified by heating with a fluoride, the silicon and other impurities being volatilized. A carbonaceous material such as coal, coke, etc., in fine ground form is ultimately mixed with the dolomite and a suitable binder such as tar added. The dolomite-carbon product is pressed into bars, rods or lumps and baked at sufficiently high temperature to carbonize the binder and impart firmness to the forms. The forms are finally subjected to intense heat and electricity in a reducing atmosphere to give calcium carbide, carbon dioxide, magnesium and other decomposition products, the volatile being carried off by the current of the reducing atmosphere.

In carrying out the process the dolomite-carbon product may be used as a conducting mass in a high frequency induction furnace, or in the form of rods or bars may be included as a resistor in an electric circuit, or the forms may be fed into a heated zone produced by an electric current, or may be fed into an arc produced at the poles of an electric furnace. When employing the last mentioned method the arc may be produced between a carbon electrode and an electrode formed of the dolomite-carbon product or between two magnesia lime carbon product electrodes. The arc may also be produced between two carbon electrodes and the dolomite-carbon product fed into the arc.—*U. S. Patent No.* 1,650,894.

Improved Wallboard. A plaster board having a composition body and coverings on each side with the margins at the side edges of the coverings partially bent back upon themselves at an angle to each other to form grooved edges.—*C. R. Birdsey, U. S. Patent No.* 1,650,930.

Rotary Kiln. A cylindrical kiln comprising a self-supporting metal shell having a smooth inner surface, this shell consisting of a plurality of similar channel sections each of which has an arcuate web with longitudinally extending flanges serving to stiffen the web, these sections being assembled edge-to-edge with their flanges in contact and bolted together. The sections are laid end-to-end throughout the length of the kiln in longitudinal alignment with their ends contacting but otherwise independent of each other. A refractory lining inside the kiln covers the inner faces of the sections.—*George McCrae, U. S. Patent No.* 1,649,609.

Improvement to Cement Grinding Mill. The grinding bodies in a ball mill or tube mill are cleaned by carrying them from the discharge end of the mill to the feed end, while the mill is in constant operation. The coarse particles at the feed end are effective in removing the film of material surrounding the grinding media.—*E. Z. Dalgaard, U. S. Patent No.* 1,649,813.

Magnesium Metal from Magnesia Compounds. A continuous process for production of pure magnesium and free from chloride or other halogen derivatives by the reduction of magnesia compounds. *U. S. Patent No.* 1,650,893.

Rotary Kiln and Cooler. The combination with a rotary kiln of a circumferential series of cooling drums supported by the kiln about itself and open at one end for the admission of cooling air, connections through which the clinker is discharged from the kilns to said drums, each of said drums having on its inner wall surface a series of longitudinal angle irons and loose chain loops connected to said angle irons to retard the movement of the clinker through the drum and to effect interchange of heat between the clinker and the air in the drum.—*J. S. Fasting, U. S. Patent No.* 1,652,168.

Plaster Board Process. A plaster board with smooth opposite sides, one side of which is provided with openings through the face covering and at which openings sufficient of the plastic material is removed during the process to form a rough and slightly hollowed area which forms the bond between the plaster board and the coat of plaster applied thereto. By the removal of a small amount of the plastic material at the openings through the surface covering there is provision for the attachment of the plaster coat and at the same time the surface of the plaster board is smooth and free of any projections to interfere with piling of the same. The board can be made on the usual wall board machine, using the special apparatus. *O. L. Routt, U. S. Patent No.* 1,646,597.

Plaster Board or Plaster Lath. The board is made having channels or key-ways formed therein and by interlocking the paper cover sheet in said channels, or key-ways, with its treated side next to the body and its untreated surface outermost. The paper is held in place in the channels, which have the overhanging sides, with the untreated side outermost. The plaster is easily applied, and adheres as fast as it can be applied because of the affinity of the paper for the moisture in the plaster, which can, of course, penetrate only to the waterproof substance on the opposite side of the paper. The application of the plaster to the board also further interlocks the paper to the key-ways or channels because the plastic matter is forced into the channels and crowds the paper even more closely into the angles or corners of the channels. *O. L. Routt, U. S. Patent No.* 1,645,598.

Traffic and Transportation

EDWIN BROOKER, Consulting Transportation and Traffic Expert
Munsey Building, Washington, D. C.

Car Loadings of Sand and Gravel, Stone and Limestone Flux

THE following are the weekly car loadings of sand and gravel, crushed stone and limestone flux (by railroad districts), as reported by the Car Service Division, American Railway Association, Washington, D. C.:

CAR LOADINGS OF SAND, GRAVEL, STONE AND LIMESTONE FLUX

District	Limestone Flux Week ended Jan. 14	Limestone Flux Week ended Jan. 21	Sand, Stone and Gravel Week ended Jan. 14	Sand, Stone and Gravel Week ended Jan. 21
Eastern	1,771	1,580	1,935	2,378
Allegheny	2,569	2,734	2,425	1,973
Pocahontas	261	269	318	333
Southern	567	555	9,098	9,539
Northwestern	580	606	1,241	1,001
Central Western	370	378	5,333	5,167
Southwestern	372	423	3,993	4,648
Total	6,490	6,545	24,343	25,036

COMPARATIVE TOTAL LOADINGS, BY DISTRICTS, 1927 AND 1928

District	Limestone Flux 1927 Period to Date Jan. 22	Limestone Flux 1928 Period to Date Jan. 21	Sand, Gravel and Stone 1927 Period to Date Jan. 22	Sand, Gravel and Stone 1928 Period to Date Jan. 21
Eastern	6,221	4,832	4,325	5,416
Allegheny	9,136	7,585	6,201	5,811
Pocahontas	372	731	1,044	915
Southern	1,444	1,464	29,803	24,194
Northwestern	2,183	1,566	4,830	2,719
Central Western	1,229	1,057	14,583	14,062
Southwestern	881	1,209	11,677	11,012
Total	21,466	18,444	72,463	64,129

COMPARATIVE TOTAL LOADINGS 1927 AND 1928

	1927	1928
Limestone flux	*21,466*	*18,444*
Sand, stone, gravel	*72,463*	*64,129*

Proposed Changes in Rates

THE following are the latest proposed changes in freight rates up to the week beginning February 11:

SOUTHERN FREIGHT ASSOCIATION DOCKET

38219. **Sand** from Chicago, Ill., etc., to Natchez, Miss. Eighth class rate of 61c now applies. Proposed rate on sand, carloads (See Note 1), from Chicago, Ill., and points taking same rates, as shown on pages 37 to 61, inclusive, of Agent Jones' Tariff 108L, to Natchez, Miss., 500c per net ton, same as rate in effect to Baton Rouge, La., and New Orleans, La.

38275. **Molding sand** between southern points. It is proposed to establish rates on **sand, molding,** carloads (See Note 3), between points in Southern Freight Association Territory, to the extent molding sand is produced, named in Agent Glenn's sand, gravel, slag, stone and chert Tariff 88, I. C. C. A606, on basis of 150% of the rates currently applicable on common sand, such as used for road aggregates.

38310. **Sand and gravel** from Hopewell and Petersburg, Va., to N. S. R. R. stations. It is proposed to establish reduced rate of 140c per net ton on sand (except glass and molding sand) and gravel, carloads (See Note 3), from Hopewell and Petersburg, Va., to N. S. R. R. stations, viz.: Corapeake, Ewell, Spraggins, Famco, Savage, Roundtree and Sunbury, N. C. Proposed rate is the same as rate in effect from Puddledock, Va.

38364. **Sand, gravel, crushed stone,** slag, etc., from, to and between points in Mississippi valley territory. The Interstate Commerce Commission in Docket 17517 prescribed single and joint line mileage scales for application between certain specified points within the south. Generally speaking, rates from, to and between points in the southeastern territory have been revised to the basis of scales prescribed in I. C. C. Docket 17517, effective October 1, 1927. It is proposed to revise the rates on these commodities on the same basis from, to and between points in Mississippi valley territory, effective June 1, 1928.

Note 1—Minimum weight marked capacity of car.

Note 2—Minimum weight 90% of marked capacity of car.

Note 3—Minimum weight 90% of marked capacity of car, except that when car is loaded to visible capacity the actual weight will apply.

ILLINOIS FREIGHT ASSOCIATION DOCKET

4257-B. **Sand, core,** carloads (See Note 3), from Van's Siding, Greenwich, West Kankakee and Kankakee, Ill., to Chicago, Ill., and points taking same rates as provided in Agent Galligan's Tariff 20Q, I. C. C. 98. Present rate, 10c per 100 lb.; proposed, 80c per net ton for local deliveries at Chicago and $1 per ton for connecting line deliveries.

4319. **Sand and gravel,** carloads, from Rockford, Ill., to Peotone and Tucker, Ill. Rates in cents per ton of 2000 lb. Present rate, 126c; proposed, 114c.

4325. **Crushed stone,** carloads, from White Bear, Mo., to Chicago Heights, Ill. Present rate, $3.20 per ton; proposed, $2.02 per ton.

3944, Sub. 1. **Sand and gravel,** carloads, from Coleman, Ill., to Sutton, Ill. Present rate, $1.15; proposed, 85c.

4338. **Crushed stone,** carloads, to Livingston, Ill. Rates per net ton.

From	Pres.	Prop.
East St. Louis, Ill.	81	63
Alton, Ill.	76	63

4341. **Sand, gravel,** chert, etc., carloads, from St. Louis, Mo. Rates in cents per ton of 2000 lb.

To (representative points)	Pres.	Prop.
French Village, Ill.	55	86
Mascoutah, Ill.	60	96
Caborn, Ind.	130	120
Grayson, Ill.	120	110
Belleville, Ill.	55	91

3841. Sub. 1. **Sand and gravel,** carloads, from Quincy, Ill., to White Bear, Mo. Rates per net ton: Present, $1.01; proposed, 65c.

NEW ENGLAND FREIGHT ASSOCIATION DOCKET

13877. **Lime, lime ashes and limestone,** carloads, minimum weight 40,000 lb., from Cheshire, Mass., to Belmont (Sou. Div.) and Belmont (Fitch. Div.), Mass, 16c. Reason—To equalize rate to contiguous points.

13881. **Agricultural lime,** carloads, minimum weight 40,000 lb., from Winooski, Fonda Jct., Highgate Springs and Swanton, Vt., to stations on the New York, Ontario and Western Ry., rates proposed on differential of 1c per 100 lb. over rates now published from New Haven Jct., Vt., to stations on the N. Y. O. & W. Ry., in Rutland R. R. I. C. C. 5881. Reason—Necessary in order to place C. V. Ry. lime shippers on a comparable basis with rates published from New Haven Jct., Vt.

13885. **Stone, broken or crushed,** carloads (See Note 2), from Branford (Pine Orchard Quarry), Conn., to Fall River, Mass., $1.25 per net ton (to expire December 31, 1928, unless sooner cancelled, changed or extended); to New Bedford, Mass., $1.45 per net ton. Reason—To provide same rate as now in effect to Fall River, Mass. Present rate to New Bedford, Mass., obsolete.

CENTRAL FREIGHT ASSOCIATION DOCKET

17528. To establish **on sand, viz., blast,** core, **engine, filter, fire or furnace, glass, grinding or polishing, loam, molding or silica,** carloads, Canfield, Ohio, to various points in C. F. A. territory, the same rates as are in effect from Ohlton, Ohio, published in Erie R. R. Tariff 104-I, I. C. C. No. A6780. For exceptions see Exhibit B, attached hereto. Present rates, sixth class.

EXHIBIT B

Exceptions (in cents per net ton)

To	Present rate from Ohlton, Ohio	Proposed rate from Canfield, Ohio
Akron, Ohio	80	90
Andover, Ohio	90	100
Aurora, Ohio	90	100
Bedford, Ohio	90	100
Burghill, Ohio	70	80
Cambridge Springs, Penn.	139	151
Carlton, Penn.	139	151
Cleveland, Ohio	90	100
Cochranton, Penn.	139	151
Coleman's, Ohio	70	60
Concord, Penn.	139	151
Corry, Penn.	139	151
Cortland, Ohio	60	70
Cowanshannoc, Penn.	139	151
Elyria, Ohio	90	100
Franklin, Penn.	139	151
Franklin Square, Ohio	70	60
Garrettsville-Hiram, Penn.	90	100
Geauga Lake, Ohio	90	100
Greenville, Penn.	101	113
Houston Jct., Penn.	113	126
Hudson, Ohio	80	90
Kenmore, Ohio	80	90
Kennard, Penn.	101	113
Latimer, Ohio	60	70
Leavittsburg, Ohio	60	70
Lisbon, Ohio	70	60
Long's, Ohio	70	60
Lorain, Ohio	90	100
McClintock, Penn.	139	151
Mahoning, Ohio	70	80
Mantua, Ohio	90	100
Millers, Penn.	139	151
Mill Village, Penn.	139	151
North Randall, Ohio	90	100
Ohlton, Ohio	.....	60
Oil City, Penn.	139	151
Orangeville, Ohio	70	80
Orangeville, Penn.	88	101
Phalanx, Ohio	70	80
Reno, Penn.	139	151
Saegertown, Penn.	139	151
Shaws, Penn.	139	151
Shenango, Penn.	101	113
Siverly, Penn.	139	151
Solon, Ohio	90	100
South Akron, Ohio	80	90
South Lorain, Ohio	90	100
Stoneboro, Penn.	139	151
Sugar Creek, Penn.	139	151
Tallmadge, Ohio	80	90
Teegarden, Ohio	70	60
Titusville, Penn.	139	151
Transfer, Penn.	101	113
Union City, Penn.	139	151
Utica, Penn.	139	151
Venango, Penn.	139	151
West Ellwood Jct., Penn.	101	113
West Point, Ohio	80	70
Rouseville, Penn.	139	151

17557. To establish on **sand, viz., blast, engine, foundry, glass, loam, marl, molding and silica,** carloads, Mulberry Grove District, viz., Bluff City, Vandalia, Lutz Spur, Mulberry Grove, Greenville,

EXHIBIT B

Station— Road—	—Ottawa— Miles	Pres. rate	—Zanesville— Miles	Pres. rate	Bear Creek and Greenup Miles	Pres.	Pro.	—Tamalco— Miles	Pro. rates	—Arenzville— Miles	Pro. rates
Adrian, Mich., N. Y. C.	304	290	209	214	391	252	290	393	290	429	290
Attica, Ind., Wabash	147	189	134	252	175	189	214	176	214	250	234
Bedford, Ind., C. I. & L.	258	239	299	290	193	189	239	193	239	270	249
Bolivar, Ind., C. C. C. & St. L.	195	.....	236	252	267	214	252	280	252	322	262
Butler, Ind., Penna.	238	290	226	.....	323	252	252	331	265	374	275
Charleston, W. Va., N. Y. C. (O. C.)	506	353	159	.....	481	403	403	481	403	538	403
Columbus, Ind., Penna.	253	290	250	.....	227	252	252	227	252	315	262
Dayton, Ohio, Penna.	321	290	127	.....	296	302	265	304	265	353	275
Delphi, Ind., Wabash	164	239	276	252	231	189	214	231	214	293	234
Elwood, Ind., Penna.	211	239	215	214	227	189	214	249	214	336	224
Fostoria, Ohio, B. & O.	320	290	148	.....	383	252	290	393	290	433	290
Gauley Bridge, W. Va., N. Y. C. (O. C.)	543	378	196	.....	518	403	403	518	403	575	403
Greencastle, Ind., Penna.	200	239	277	252	147	189	202	154	202	217	222
Hibbard, Ind., Penna.	163	239	279	.....	279	214	239	275	239	321	259
Huntington, W. Va., B. & O.	456	353	144	.....	431	403	403	431	403	488	403
Kenton, Ohio, N. Y. C.	313	290	113	.....	372	252	290	378	290	404	290
Lansing, Mich., M. C.	304	290	297	252	412	252	290	418	290	452	290
Loveland, Ohio, Penna.	337	290	144	.....	315	302	302	315	302	390	312
Marietta, Ohio, Penna.	499	353	74	.....	477	302	360	480	360	534	360
Marysville, Mich., P. H. & D.	418	290	294	.....	508	265	315	507	315	546	315
Monticello, Ind., Penna.	151	239	277	.....	238	189	239	238	239	297	259
Newark, Ohio, Penna.	403	290	25	.....	400	302	302	407	302	459	312
North Detroit, Mich., M. C.	363	290	237	.....	450	252	290	452	290	488	290
Peoria, Ohio, N. Y. C. (O. C.)	346	290	92	.....	368	252	290	373	290	405	290
Pittsburgh, Penn., Penn.	.....	353	.....	.....	.....	403	403	817	403	817	403
Portsmouth, Ohio, B. & O.	456	353	136	.....	431	302	340	431	340	488	360
Rochester, Ind., N. Y. C. & St. L.	196	239	262	252	264	214	252	277	252	319	262
Seymour, Ind., Penna.	284	290	256	.....	236	252	252	236	252	309	262
S. Whitely, Ind., Penna.	204	265	265	239	286	214	252	290	252	332	262
Sullivan, Ind., C. & E. I.	204	214	349	280	113	151	239	120	239	215	259
Toledo, Ohio, Penna.	320	290	162	.....	402	252	290	402	290	437	300
Versailles, Ohio, C. C. C. & St. L.	290	290	162	.....	308	252	265	317	265	358	275
Washington C. H., Ohio, Penna.	367	340	91	.....	353	302	302	359	302	425	312
Wolcottville, Ind., Penna.	228	239	249	252	333	252	252	221	252	379	262

Rates are in cents per net ton.

Greenup, Bear Creek, Tamalco, also Arenzville, Ill., to Michigan, Ohio, Indiana, Kentucky, West Virginia, Pennsylvania, rates as illustrated in Exhibit B attached. Present rates—As illustrated in Exhibit B attached.

17609. To establish on large **boulders or oversize gravel**, carloads (See Note 3), Lafayette, Ind., to Central Freight Association territory, rates on basis of 75% of sixth class. Present rate, sixth class.

17613. To establish on **crushed stone**, carloads, Sandusky and North Baltimore, Ohio, to Ohio, rates as shown below, in cents per net ton:

To—	Sandusky Pres.	Prop.	No. Baltimore Pres.	Prop.
Ramey	70	80	80	90
Hereford	70	80	80	90
Nova	70	80	80	90
Sullivan	70	80	80	90
Homer	80	....	90	....
Lodi	80	....	90	....
Creston	80	....	90	....
Sterling	80	....	90	....
Rittman	80	....	90	....
Easton	80	....	90	....
Warwick	80	....	90	....
Clinton	80	....	90	....
Barberton (B. & O.)	80	....	90	....
Akron (B. & O.)	80	....	90	....

Also to establish on crushed stone from points named above to Carey and Marion, Ohio, rate of 90c per net ton. Present rate, 80c per net ton.

17614. To establish on **sand and gravel**, carloads, from Brevoorts, Ind., to Illinois stations on the C. C. C. & St. L. following rates:

To	Miles	Prop.	To	Miles	Prop.
Paris	80	$0.80	Windsor	130	$1.03
Midland	81	.80	Middleworth	136	1.03
Conlogue	85	.88	Shelbyville	141	1.03
Dudley	89	.88	Tower Hill	150	1.10
Kansas	94	.88	Pana	156	1.10
Ashmore	98	.90	Rosamond	161	1.13
Embarrass	102	.90	Ohlman	165	1.13
Charleston	107	.90	Nokomis	169	1.13
Loxa	112	.90	Witt	174	1.13
Mattoon	118	.90	Irving	179	1.13
Gays	124	1.03	Hillsboro	184	1.13

17625. To establish on **crushed stone or agricultural limestone** (not ground or pulverized), in bulk, in open top cars only, carloads, Chicago, Ill., and points named on page 4 of C. F. A. T. B. Tariff 197J, I. C. C. 1944, to Barryton, Weidman, Rodney and Wyman, Mich., rate of 230c per net ton. Present rates, sixth class.

17627. To establish on **sand** (except blast, core, engine, filter, fire or furnace, foundry, glass, grinding or polishing, loam, molding or silica) **and gravel**, carloads, Leeland, Ind., to Milford Jct., Ind., rate of 50c per net ton. Present rate, 63c per net ton.

17628. To establish on **grinding sand**, carloads, Muskegon, Mich., to Rossford, Ohio, rate of $1.13 per net ton. Present rate, $1.26 per net ton.

17634. To establish on **sand and gravel**, carloads, Steubenville, Ohio, to Broadacre, Ohio, rate of 60c per net ton. Present rate, 70c per net ton.

WESTERN TRUNK LINE DOCKET

6366. **Sand and gravel**, carloads. Minimum weight same as provided in Item 2480-A, W. T. L. 1-Q. From East St. Louis, Ill., to Council Bluffs, Iowa, and Omaha, Neb. Present rate, 18½c (Class E); proposed, 11c per 100 lb.

853F, Sup. 1. **Sand**, carloads, usual minimum weight, from Eggleston, Minn., to all destinations to which rates are now provided on sand from Red Wing, Minn., in W. T. L. Tariff 49Q (except Detroit and Ecorse, Mich., these destinations being taken care of by Docket Advice No. 853F). Present rates, combination basis; proposed, the same rates as currently applicable from Red Wing, Minn.

6025A. **Limestone, agricultural**, carloads, from Valmeyer, Ill., to points in Missouri on the Missouri Pacific, Webster Groves to Myrick, inclusive, as shown in Missouri Pacific Tariff 7908B, I. C. C. A7045. Present, various rates; proposed, publish rates based on the scale prescribed by the Interstate Commerce Commission in I. C. C. Docket 9702, without any addition for river transfer. Below is an example:

To—	Pres.	Prop.
Kirkwood	*100	* 70
Jefferson City	*160	*140
Versailles	† 24½	*160
Marshall	† 24½	*170

*Cents per ton of 2000 lb. †Cents per 100 lb.

Minimum weight—Present, various; proposed (See Note 3), but not less than 60,000 lb.

TRUNK LINE ASSOCIATION DOCKET

M-856. **Sand and gravel**, carloads (See Note 2), from Pier 62, South Philadelphia, Penn., to East Side, Philadelphia, Penn., 50c per ton of 2000 lb. Reason—Proposed rate compares favorably with rates on other commodities from and to same points as per B. & O. R. R., I. C. C. No. 21026.

17628. **Stone, crushed**, screenings and tailings, carloads (See Note 2), from Worthington, Penn., to Sagamore, Penn., $1.10 per ton of 2000 lb. Reason—Proposed rate is same as now in effect from Kittanning, Penn.

17631. **Stone, crushed**, natural (other than bituminous asphalt rock), N. O. I. B. N. in O. C., carloads (See Note 2), from Avis, Penn., to Allenwood, Penn., $1.20 per ton of 2000 lb. Reason—Proposed rates compare favorably with rates from Avis, Penn., to Halls, Muncy and Montgomery, Penn., as per N. Y. C. I. C. C. N. Y. C. No. 15543.

17633. **Stone, crushed**, screenings and tailings, carloads (See Note 2), from Worthington, Penn., to Bakerstown, Penn., 90c per ton of 2000 lb. Reason—Proposed rate is based on joint mileage scale prescribed by the Pennsylvania Public Service Commission in Docket No. 6951.

17649. **Limestone screenings**, carloads (See Note 2), from Ogdensburg, N. J., to Nazareth, Penn., $1.50 per ton of 2000 lb. Reason—Proposed rate is comparable with rates from Atlas, Hamburg and Lime Crest, N. J.

17652. **Fluxing lime**, carloads, minimum weight 36,000 lb., from Ashcom, Penn., to Pittsburgh, Penn.; Karns to Aspinwall, Penn., inclusive; Brilliant to Oakmont, Penn., inclusive; Hulton to Garver's Ferry, Penn., inclusive, 9½c per 100 lb. Reason—To establish the same rate as is now in effect from Bellefonte, Penn., and Pleasant Gap, Penn., as per P. R. R. G. O. I. C. C. No. 14302.

17667. **Agricultural, land, chemical, gas or glass lime**, carloads, minimum weight 36,000 lb., also **ground limestone**, carloads, minimum weight 50,000 lb., from Bellefonte and Pleasant Gap, Penn., to Port Allegany to Newfield Jct., Penn., inclusive, 13c per 100 lb. Reason—Proposed rates are fairly comparable with rates now in force from Buffalo, N. Y., to Coudersport, Coleburg and Newfield Jct., Penn., as per P. R. R. G. O. I. C. C. 14567.

17678. **Sand, blast, engine, foundry, molding, silica, quartz, silex or ground flint**, carloads (See Note 2), from Mapleton District, Penn., to Royersford, Pottstown, Stowe, Monocacy, Birdsboro and Reading, Penn., $2.52 per ton of 2000 lb. Reason—Proposed rate is comparable with rate now in force from Spring City, Penn., as per P. R. R. G. O. I. C. C. 14700.

17686. **Broken stone**, carloads (See Note 2), from Port Deposit, Md., to Long Branch, N. J., $2.05 per ton of 2000 lb. Reason—Proposed rate is comparable with rates from Port Deposit, Md., to Jersey City, South Amboy and Sea Girt, N. J., as per P. R. R. G. O. I. C. C. No. 13960.

17689. **Fluxing limestone**, crude or crushed, carloads (See Note 3).

From	To Gloucester, N. J. Prop. Rate
Knickerbocker to Howellville, Penn.	139
King of Prussia, Penn.	139
Henderson to Blue Bells, Penn.	126
Union Stone Co., Penn.	164
Chickies to Bainbridge, Penn.	164
Rheems, Penn.	164
Steelton, Penn.	176
Conshohocken to Ivy Rock, Penn.	126
Earnest to Norristown, Penn.	126
Aldham to Devault, Penn.	139
Temple, Penn.	164
Alexandria to Frankstown, Penn.	202
Union Furnace to Tyrone Forge, Penn.	202
Bellefonte, Penn.	202
Pleasant Gap, Penn.	202
Williamson, Penn.	202
Falling Waters to Bunker Hill, W. Va.	202

Rates in cents per ton of 2240 lb.

Reason—Proposed rates are comparable with rates now in force to Camden, N. J., as per P. R. R. G. O. I. C. C. No. 14567.

17691. **Marble, crushed, chips, dust, rubble and waste**, carloads, minimum weight 50,000 lb., from Pleasantville, Patterson and Wingdale, N. Y., to East Orange, Lakeview, N. J., 16c; Kearny and Hackensack, N. J., 15½c per 100 lb. Reason—Proposed rates are comparable with rates on like commodities from and to points in the same territory.

17701. **Sand**, N. O. I. B. N. in O. C., other than blast, engine, foundry, glass, molding, quartz, silica, or silex and gravel, carloads (See Note 2), proposed rates per net ton, from Fish's Eddy, N. Y., to following Pennsylvania points:

Avoca	$1.15	Pittston	$1.25
Dunmore	1.05	Sebastopol	1.25
Hillside Jct.	1.15	Scranton	1.05
Jessu	1.05		

17710. **Unburned ground limestone**, carloads, minimum weight 50,000 lb., from Chaumont, N. Y., to stations on N. Y. C. R. R., Brooklyn, N. Y., stations, Long Island City stations, $3.50, from New York, N. Y., stations, including New York lighterage to Rhinecliff, N. Y., inclusive, $3 per ton of 2000 lb. Reason—Proposed rates are comparable with rates now in force from Gouverneur, N. Y., to same points of destination as per N. Y. C. I. C. C. N. Y. C. No. 15371.

Dewey Portland to Produce Crushed Stone at Davenport Plant

ACCORDING to plans recently announced by H. F. Tyler, vice-president of the Dewey Portland Cement Co. of Kansas City, Mo., improvements costing about $150,000 will be made shortly at the Davenport plant of the Dewey company. The object of the work is to provide for the production of crushed stone, and also for the manufacture of cement products. A second quarry, just east of the present crushing plant, has already been opened, and from this quarry stone will be taken for use in highway construction in that portion of Iowa. Four additional side tracks, totaling a mile in length, are to be laid down as soon as possible. The increased production schedule will place the plant practically on a 24-hour basis throughout the year, and therefore a large flood-lighting system is being installed along with the other improvements.

The program of expansion, which was begun several months ago to increase the cement production approximately 50%, is rapidly nearing completion. The program called for the installation of a third kiln, a boiler plant and some other new equipment, and it is now announced that the new kiln is expected to be in operation by the first of May. When the work is completed the plant will have a capacity of 5000 bbl. daily.

To the Ladies!

THE RECENT West Baden, Ind., convention of the National Crushed Stone Association was graced by the attendance of more ladies than usual, comparing their numbers with those in other years. The good times they enjoyed were due to the untiring efforts of Mrs. Grace M. Evans, in charge of ladies' entertainment, who arranged a program which furnished pleasurable activities during the entire convention. Mrs. Evans, by the way, has the distinction of being the only lady member of the National Crushed Stone Association and is active in conducting the affairs of the Monon Crushed Stone Co., Monon, Ind.

At one of the closing entertainments, the ladies present remembered Mrs. Evans' well-deserved efforts by presenting her with a handsome silk Oriental rug, Mrs. F. O. Earnshaw making the presentation address. The illustration below shows most of the ladies attending the convention.

There is little doubt that the ladies helped make the convention the success that it was and it is to be hoped that next year their numbers at the annual meeting will be increased.

Miller Construction Co. Building New Rock Plant in Oregon

THE Miller Construction Co. of Klamath Falls, Ore., has leased six acres of land four miles south of that city on which it will erect a modern rock crushing plant. The Miller company is already operating one plant at Pelican City, Ore., and the new plant is necessary to meet increased demands for stone. The property is a part of the large dairy ranch of C. L. Holliday, and has been leased for 10 years on a royalty basis. Already a crew of men are at work on the construction of the crusher, which is expected to be completed before the first of April. The plant, which will cost $30,000, will be thoroughly up-to-date throughout.—*Klamath Falls* (Ore.) *Herald.*

British Quarrying Exhibition

THE popularity of the British exhibition of quarrying plant and machinery and building plant and materials to be held in June for the third consecutive year, can be gaged from the number of exhibitors who have already booked up spaces. This year, Stanley Park, Blackpool is the place chosen, and all the largest spaces, and many of the smaller, are taken by exhibitors who have also been at the first two exhibitions. Some larger spaces than any formerly offered were arranged for this year, and these were all booked up as soon as the plan of the exhibition was circulated.

Alabama Lime and Stone Co. Completing First Unit of New Plant

THE Alabama Lime and Stone Co., Birmingham, Ala., is just completing the first unit of its new plant at Calera, Ala. This unit consists of two kilns and a hydrating plant. The kilns are 17 ft. in diameter and are 72 ft. high above the firing floor. The new quarry was furnished with equipment from a large crushing plant at Monmouth, Ill., which was never put into operation, because of the poor character of the rock. Also the equipment of the McDonough Ore and Mining Co., which company belongs to the Alabama company, is to be used at the new plant, as the McDonough plant at Gates City, Ala., is now dismantled.

The new plant will eventually have a capacity of approximately 3000 tons of crushed rock daily, of which a good portion will go to the kilns, and the remainder will be for sale. The plant will have eight kilns when it is finally completed. At present the two kilns have a capacity of about 100 tons of lime per day. The new plant is thoroughly modern in every respect. The raw material in handled entirely automatically. The hydrating plant is built according to plans of the Schaffer Engineering Co.—*Dixie Manufacturer.*

U. S. Gypsum to Build Plant in Boston

ANNOUNCEMENT was recently made in Boston that the United States Gypsum Co. of Chicago would shortly commence the construction of a $1,500,000 plant at Charlestown, in Boston. The new plant is to be located on a portion of the Mystic Docks property, which is now controlled by the Boston and Maine R. R. The plant will employ 500 persons, according to present reports. At a recent meeting of the board of appeal of the Boston building department the permit for the construction of the plant was approved. —*Boston* (Mass.) *Globe.*

Some of the ladies who attended the West Baden, Ind., convention. The arrow points to Mrs. Grace M. Evans, hostess to the ladies

Engine Sand Specifications

Railroads Making Rigid Requirements with New Methods of Testing

ONLY a few years ago engine sand was defined by one producer as "sand that could not be sold for much of anything else." Almost any sand that was fairly clean and not too large to run through an inch pipe and not so small as to be dusty was acceptable. Then the railroads began to experiment and found there was a great difference in sands for such a use. Too large particles bounced off the rails and too fine particles did not have the necessary body to give traction. Since then railroads have been somewhat particular about the grain sizes of engine sands.

Recently engine sands have been put to another use than that of providing a foothold on a slippery rail. On some of the western roads on which oil is used as fuel they are employed as blast sands to clean out flues. This use calls for hard, infusible grains and accounts for two new requirements, withstanding an acid test and infusibility.

In order to be sure that the sands are perfectly clean, a rather severe caking test has been devised. Put into plain terms, this test is made by saturating the sand with distilled water and pouring it into a piece of 1-in. pipe 18-in. long which is capped at the bottom. The sand is then thoroughly dried with the pipe in an upright position. After the sand is dry it must all run through a ½-in. hole which has been drilled in the cap on the bottom of the pipe (and closed with a plug while the sand is drying) without shaking.

The caking test is one that is likely to be adopted by other roads than the few that have already adopted it. It is a test that is fair, but some intelligence will have to be used in applying it. It would be possible to ram damp sand into a pipe so that it might arch even after it had been dried, according to one man's experience. But this could not happen if the sand was really saturated, to fill all the voids with water, and then poured into the pipe.

The most recent engine sand specifications of three southwestern roads follow:

The Atchison, Topeka and Santa Fe Railway System Specifications

1. *Scope:* This specification covers sand for locomotive sander use and for sanding out flues of oil burner locomotives.

2. *Chemical Analysis:* The sand shall conform to the following requirements as to chemical composition:

	Per cents
Silica and aluminum oxide	Min. 90.0
Iron oxide	Max. 2.5
Clay, adobe, decayed vegetable material and silt	Max. 2.0

3. Determination of clay, adobe, decayed vegetable matter and silt shall be made as follows:

Test samples shall be thoroughly washed in a 1.1 specific gravity solution of hydrochloric acid after which the sand shall be washed with a 50-50 solution by volume of distilled water and ammonia, then the sand shall be washed with distilled water and dried and loss determined.

4. *Physical Properties:* The sand shall be graded on standard sieves, and not over 10% shall be held on a sieve with 20 meshes to the inch, nor more than 10% shall pass through a sieve with 80 meshes to the inch. The sieves shall conform to the American Society for Testing Materials' standard.

5. *Caking Test:* In order that sands shall move freely in drying stove and sand dome, the sand shall stand the following test: A quantity of sand shall be thoroughly saturated with distilled water in a container 18 in. high and 1 in. in diameter. After drying, the sand shall run freely through an opening of ½ in. in the bottom of the container without shaking.

6. *Inspection:* A 50 lb. sample as representative of the material under consideration shall be selected at random from various locations in the pit or supply and forwarded to the Engineer of Tests, Topeka, Kan., to be subjected to analyses and tests as outlined herein.

7. *Rejection:* The pits represented by the samples not meeting requirements of these tests shall not be used for sand for locomotive purposes.

8. *Rehearing:* Samples tested in accordance with these specifications, which represent rejected material, shall be preserved for 14 days from date of test report.

9. All specifications of previous date for this material are hereby annulled.

10. These sands shall not fuse when submitted to a temperature of 2700 deg. F.

Chicago Great Western Railway Co. Specifications

1. This specification covers sand for filling the sand boxes of locomotives to be used in sanding the rails.

2. It shall be a clean, sharp, washed and screened sand.

3. It shall conform to the following mesh analysis:

	Per cents
Clay, dirt, impurities, etc.	Max. 1.0
Between 10-60 mesh	Min. 90.0
Soluble in 1:1 hydrochloric acid	Max. 3.0

Note: The clay, dirt, etc., to be determined by careful panning and washing in a large flat pan and followed by drying and weighing to determine the loss.

Missouri-Kansas-Texas Railroad Co. Specifications

On any future orders which we send to you we will specify that "sand must pass through a No. 10 and be retained on a No. 80-mesh sieve." In addition, we would prefer that the largest percentage pass through a No. 20 and be retained on a No. 40-mesh sieve.

Peters Sand and Gravel Acquires Burlington Pit

A RECENT announcement from Burlington, Wis., states that the Peters Sand and Gravel Co., of Burlington, has completed the purchase of the land and equipment of the Burlington Sand and Gravel Co., which went into bankruptcy several years ago. The property acquired by the Peters company contains 86 acres of gravel land, immediately adjacent to the present pit of the company and supplied with transportation by the C. M. & St. P. R. R. It is not stated at present what development will be made of the new property, but it is understood that the land was bought to allow for a considerable future expansion of the company. It is also stated that the company contemplates doubling the output of the plant during 1928. Last year the production amounted to approximately 150,000 tons of sand and gravel.—*Racine* (Wis.) *Journal.*

Resource Survey of Cincinnati Territory Prepared

UNDER the direction of the Commercial Club of Cincinnati, the University of Cincinnati has recently completed a resource survey of the territory surrounding that city. The survey gives a comprehensive report of the materials located within a radius of 300 miles of Cincinnati, including limestone, sand and gravel, silica sand, phosphate rock and fluorite, as well as a number of other natural resources such as coal, clay, lumber and agricultural products. The report suggests that a number of industries could well be developed in the territory, among which the making of concrete products is recommended and the production of portland cement is given a qualified approval. The report is intended to show the possibilities of the region, but the university does not intend to give advice on particular problems of industrial location other than in this general way.

Much of the work on the survey was done by the department of geology and geography of the university under the direction of Dean Herman Schneider. The surveys of cement and lime resources are the work of Walter H. Bucher, and cover the subject thoroughly. Considerable work was also done by students working for university degrees. In making up the reports, consideration was taken, not only of the size and character of the deposits, but of the possibility of use due to transportation facilities, depth of overburden, and other factors as well.

The Rock Products Market

Wholesale Prices of Crushed Stone

Prices given are per ton, F.O.B., at producing point or nearest shipping point

Crushed Limestone

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
EASTERN:						
Buffalo, N. Y.	1.30	1.30	1.30	1.30	1.30	1.30
Chaumont, N. Y.	.50	1.75	1.75	1.50	1.50	1.50
Chazy, N. Y.	.75	.....	1.60	1.30	1.30	1.30
Dundas, Ont.	.30	1.05	1.05	.90	.90	.90
Frederick, Md.	.50@1.00	1.35@1.50	1.15@1.50	1.10@1.15	1.05@1.10	1.05@1.10
Ft. Spring, W. Va.	.50	1.40	1.40	1.35	1.20	.....
Munns, N. Y.	1.00	1.50	1.50	1.40	1.25	.....
Prospect, N. Y.	1.00	1.40	1.25	1.25	1.25	.....
Rochester, N. Y.—Dolomite	1.50	1.50	1.50	1.50	1.50	1.50
St. Vincent de Paul, Que. (n)	.80	1.45	1.15	.95	.95	1.10
Walford, Penn.	.....	.....	1.35h	1.35h	1.35h	1.35h
Watertown, N. Y.	1.00	.....	1.75	1.50	1.50	1.50
Western New York	.85	1.25	1.25	1.25	1.25	1.25
CENTRAL:						
Afton, Mich.	.....	.....	.50	.50	.50	1.50
Alton, Ill.	1.85	.....	1.85	.....	.....	.....
Columbia and Krause, Ill.	.90@1.20	.90@1.20	1.00@1.20	1.00@1.20	1.00@1.20	1.25
Cypress, Ill.	1.25	1.15	1.10	1.00	1.00	1.00
Dubuque, Iowa (e)	.75	1.20@1.30	.....	1.20@1.30	1.20@1.25	.....
Greencastle, Ind.	1.25	1.25	1.15	1.05	.95	.95
Lannon, Wis.	.80	1.00	1.00	.90	.90	.90
Linwood, Iowa (f)	1.10	1.55	1.55	1.55	.....	.....
McCook, Ill.	1.00	1.25	1.25	1.25	1.25	1.25
Marblehead, Ohio (l)	.55	.80	.80	.80	.80	.80
Milltown, Ind.	.....	.90@1.00	1.00@1.10	.90@1.00	.85@ .90	.85@ .90
Sheboygan, Wis.	1.10	1.10	1.10	1.10	1.10	.....
Stone City, Iowa	.75	.....	1.20	1.05	1.00	.....
Toledo, Ohio	1.60	1.70	1.70	1.60	1.60	1.60
Toronto, Canada (m)	2.50	3.00	3.00	2.85	2.85	2.85
Valmeyer, Ill. (fluxing limestone)	.90@1.20	.....	.....	1.75	.....	1.75
Waukesha, Wis.	.90	.90	.90	.90	.90	.90
Wisconsin Points	.50	.....	1.00	.90	.90	.....
Youngstown, Ohio	.70j	1.25l@1.35h	1.25l@1.35h	1.25l@1.35h	1.25l@1.35h	1.25l@1.35h
SOUTHERN:						
Atlas, Ky.	.50	1.00	1.00	1.00	1.00	1.00
Cartersville, Ga.	1.65	1.65	1.65	1.35	1.15	1.15
Chico and Bridgeport, Tex.	1.00	1.30	1.25	1.20	1.15	1.10
El Paso, Tex.	1.00	1.00	1.00	1.00	1.00	.....
Graystone, Ala.	Crusher run, screened, $1 per ton					
Kendrick and Santos, Fla.	3½ in. and less, $1 per ton					
Rocky Point, Va.	.50@ .75	1.40@1.60	1.30@1.40	1.15@1.25	1.10@1.20	1.00@1.05
WESTERN:						
Atchison, Kan.	.50	1.80	1.80	1.80	1.80	1.80
Blue Springs & Wymore, Neb.	.25	1.45	1.45	1.35c	1.25d	1.20
Cape Girardeau, Mo.	1.25	1.25	1.25	1.25	1.00	.....
Rock Hill, St. Louis Co., Mo.	1.30	1.00	1.00	1.00	1.00	1.00

Crushed Trap Rock

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
Branford, Conn.	.80	1.70	1.45	1.20	1.05	.....
Duluth, Minn.	.90	2.00	1.75	1.55	1.25	1.25
Eastern Maryland	1.00	1.60	1.60	1.50	1.35	1.35
Eastern Massachusetts	.85	1.75	1.75	1.25	1.25	1.25
Eastern New York	.75	1.25	1.25	1.25	1.25	1.25
Eastern Pennsylvania	1.10	1.70	1.60	1.50	1.35	1.35
Knippa, Tex.	2.50	2.25	1.65	1.35	1.25	.....
New Britain, Plainville, Rocky Hill, Wallingford, Meriden, Mt. Carmel, Conn.	.80	1.70	1.45	1.20	1.05	.....
Northern New Jersey	1.40@1.80	2.30	1.40@2.30	1.40@1.70	1.70	.....
Richmond, Calif.	.75	.....	1.00	1.00	1.00	.....
San Diego, Calif.	.50@ .75	1.25@1.50	1.25@1.50	1.10@1.25	1.10@1.25	.....
Springfield, N. J.	2.10	2.20	2.10	1.70	1.70	1.60
Toronto, Canad (m)	.....	5.80	4.05	4.05	.....	.....
Westfield, Mass.	.60	1.50	1.35	1.20	1.10	.....

Miscellaneous Crushed Stone

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
Berlin, Utley, Montello and Red Granite, Wis.—Granite	1.80	1.70	1.50	1.40	1.40	.....
Cayce, S. C.	.50	2.00	1.75@1.90	1.75@1.90	1.65@1.75	.....
Eastern Penn.—Sandstone	1.35	1.70	1.65	1.40	1.40	1.40
Eastern Penn.—Quartzite	1.20	1.35	1.25	1.20	1.20	1.20
Emathla, Fla.—Flint rock	1.00	.....	2.35	.....	.....	.....
Lithonia, Ga.—Granite	.75a	2.00b	1.75	1.40	1.35	1.25
Lohrville, Wis.—Granite	1.65	1.70	1.65	1.45	1.50	.....
Middlebrook, Mo.	3.00@3.50	.....	2.00@2.25	2.00@2.25	.....	1.25@3.00
Richmond, Calif.—Quartzite	.75	.....	1.00	1.00	1.00	.....
Somerset, Penn. (sand-rock)	.....	.....	1.50 to 1.85	.....	.....	.....
Toccoa, Ga.	.....	.....	1.40	1.25	1.25	1.25

(a) Sand. (b) to ⅛ in. (c) 1 in., 1.40. (d) 2 in., 1.30. (e) Price net after 10c cash discount deducted. (f) 1 in. to ¾ in., 1.45; 2 in. to ¼ in., 1.35. High calcite fluxing stone, 1.40. (h) Less 10c discount. (j) Less 10% net ton. (l) Less .05. (m) Plus .25 per ton for winter delivery. (n) Crusher run for ballast. .80.

Agricultural Limestone

(Pulverized)

Alton, Ill.—Analysis, 98% $CaCO_3$, 0.01% $MgCO_3$; 90% thru 100 mesh	4.50
Atlas, Ky.—90% thru 100 mesh	2.00
50% thru 100 mesh	1.00
Bettendorf and Moline, Ill.—Analysis, $CaCO_3$, 97%; 2% $MgCO_3$; 50% thru 100 mesh, 1.50; 50% thru 4 mesh	1.50
Blackwater, Mo.—100% thru 4 mesh	1.00
Branchton, Penn.—100% thru 20 mesh; 60% thru 100 mesh; 45% thru 200 mesh	5.00
Cape Girardeau, Mo.—Analysis, $CaCO_3$, 93½%; $MgCO_3$, 3½%; 50% thru 50 mesh	1.50
Cartersville, Ga.—90% thru 4 mesh	1.50
Pulverized, per ton	2.00
Charleston, W. Va.—Marl, per ton, bulk	3.00
Chaumont, N. Y.—Pulverized limestone, bags, 4.00; bulk	2.50
Cypress, Ill.—Analysis, 88% $CaCO_3$; 10% $MgCO_3$; all sizes	1.25
Ft. Spring, W. Va.—50% thru 50 mesh	1.00
Hartford, Conn.—Paper bags, 4.25; cloth bags, 4.75; bulk	3.25
Hillsville, Penn.—Analysis, 94% $CaCO_3$; 1.40% $MgCO_3$; 75% thru 100 mesh; sacked	5.00
Hot Springs and Greensboro, N. C.—Analysis, $CaCO_3$, 98-99%; $MgCO_3$, 42%; pulverized; 67% thru 200 mesh; bags	3.95
Bulk	2.70
Jamesville, N. Y.—Analysis 89% $CaCO_3$, 4% $MgCO_3$; pulverized; bags, 4.25; bulk	2.75
Joliet, Ill.—Analysis, 52% $CaCO_3$; 44% $MgCO_3$; 90% thru 100 mesh	3.50
Knoxville, Tenn.—80% thru 100 mesh; bags, 3.95; bulk	2.70
Ladds, Ga.—Analysis, $CaCO_3$, 64%; $MgCO_3$, 32%; pulverized; 50% thru 50 mesh	1.50@ 2.75
Marlbrook, Va.—Analysis, 80% $CaCO_3$; 10% $MgCO_3$; bulk, 1.75; bags	3.75
Marl—Analysis, 90% $CaCO_3$; 10% $MgCO_3$; bulk, 2:25; bags	4.00
Marion, Va.—Analysis, 90% $CaCO_3$, pulverized, per ton	2.00
Middlebury, Vt.—Analysis, 90.05% $CaCO_3$; 90% thru 50 mesh	6.00
Milltown, Ind.—Analysis, 94.50% $CaCO_3$, 33% thru 50 mesh, 40% thru 50 mesh; bulk	1.35@ 1.60
Olive Hill, Ky.—90% thru 4 mesh	1.00
Piqua, Ohio—Total neutralizing power 95.3%; 99% thru 10, 60% thru 50; 50% thru 100	2.50@ 2.75
100% thru 10, 90% thru 50, 80% thru 100; bags, 5.10; bulk	3.60
99% thru 100, 85% thru 200; bags, 7.00; bulk	5.50
Rocky Point, Va.—Analysis, $CaCO_3$, 97%; 50% thru 200 mesh, burlap bags, 3.50; paper, 3.25; bulk	2.00
Syracuse, N. Y.—Analysis 89% $CaCO_3$; $MgCO_3$, 4%; bags, 4.25; bulk	2.75
Toledo, Ohio—30% thru 50 mesh	2.25
Watertown, N. Y.—Analysis, 96-99% $CaCO_3$; 50% thru 100 mesh; bags, 4.00; bulk	2.50

Agricultural Limestone

(Crushed)

Alton, Ill.—Analysis, 99% $CaCO_3$, 0.3% $MgCO_3$; 50% thru 4 mesh	3.00
Atlas, Ky.—90% thru 4 mesh	1.00
Bedford, Ind.—Analysis, 98.5% $CaCO_3$, 0.5%; $MgCO_3$; 90% thru 10 mesh	1.50
Brandon, Vt.—Bulk	4.00

(Continued on next page)

Agricultural Limestone

Chicago, Ill. — 50% thru 100 mesh; 90% thru 4 mesh	.80
Chico and Bridgeport, Tex. — 50% thru 100 mesh	1.50
Columbia, Krause, Valmeyer, Ill. — Analysis, 90% $CaCO_3$; 100% thru 4 mesh	1.10@ 1.50
Cypress, Ill.—90% thru 50 mesh, 50% thru 100 mesh, 90% thru 50 mesh, 90% thru 4 mesh, 50% thru 4 mesh	1.35
Danbury, Conn.; Adams, Ashley Falls and West Stockbridge, Mass.—Analysis 90% $CaCO_3$, 5% $MaCO_3$; 50% thru 100 mesh, bulk	3.50
100-lb. paper bags	4.75
100-lb. cloth bags	5.25
(All prices less 2%, 15 days.)	
Dundas, Ont.—Analysis, 54% $CaCO_3$; $MgCO_3$, 43%; 50% thru 50 mesh	1.00
Ft. Springs, W. Va.—Analysis, 90% $CaCO_3$; 90% thru 50 mesh	1.50
Kansas City, Mo. — 50% thru 100 mesh	1.00
Lannon, Wis.—Analysis, 54% $CaCO_3$, 44% $MgCO_3$; 99% thru 10 mesh; 46% thru 60 mesh	2.00
Screenings (¼ in. to dust)	1.00
Linwood, Iowa — Analysis, 96-86.5% $CaCO_3$, 1.39% or less $MgCO_3$; 100% thru 4 mesh	1.00
40% thru 50 mesh	1.00
Marblehead, Ohio—90% thru 100 mesh	3.00
90% thru 50 mesh	2.00
90% thru 4 mesh	1.00
Mayville, Wis.—Analysis, 54% $CaCO_3$, 44% $MgCO_3$; 50% thru 50 mesh	1.85@ 2.35
McCook, Ill.—90% thru 4 mesh	.90
Middlepoint, Bellevue, Bloomville, Kenton and Whitehouse, Ohio; Monroe, Mich.; Bluffton, Greencastle and Logansport, Ind.—85% thru 10 mesh, 20% thru 100 mesh	1.50
Moline, Ill., and Bettendorf, Iowa—Analysis, 97% $CaCO_3$, 2% $MgCO_3$; 50% thru 100 mesh; 50% thru 4 mesh	1.50
Mountville, Va. — Analysis, 62.54% $CaCO_3$; $MgCO_3$, 35.94%, 100% thru 20 mesh; 50% thru 100 mesh, bags	5.00
Pixley, Mo. — Analysis, 96% $CaCO_3$; 50% thru 50 mesh	1.25
50% thru 100 mesh; 90% thru 50 mesh; 50% thru 50 mesh; 90% thru 4 mesh; 50% thru 4 mesh	1.65
River Rouge, Mich. — Analysis, 54% $CaCO_3$, 40% $MgCO_3$; bulk	.80@ 1.40
Stone City, Iowa — Analysis, 98% $CaCO_3$; 50% thru 50 mesh	.75
Tulsa, Okla.—Analysis $CaCO_3$, 86.15%, 1.25% $MgCO_3$, all sizes	1.25
Waukesha, Wis.—90% thru 100 mesh, 4.50; 50% thru 100 mesh	2.35

Pulverized Limestone for Coal Operators

Hillsville, Penn., sacks, 4.50; bulk	3.00
Joliet, Ill.—Analysis, 55% $CaCO_3$; 45% $MgCO_3$; 95% thru 100 mesh; paper bags	3.50
Marblehead, Ohio — Analysis, 83.54% $CaCO_3$; 14.92% $MgCO_3$; 99.8% thru 100 mesh; sacks	4.25
Piqua, Ohio, sacks, 4.50@5.00; bulk	3.00@ 3.50
Rocky Point, Va.—85% thru 200 mesh, bulk	2.25@ 3.50
Waukesha, Wis.—90% thru 100 mesh, bulk	4.50

Glass Sand

Silica sand is quoted washed, dried and screened unless otherwise stated. Prices per ton f.o.b. producing plant.

Buffalo, N. Y.	2.00@ 2.50
Cedarville and S. Vineland, N. J.	*1.75@ 2.25
Estill Springs and Sewanee, Tenn.	1.50
Franklin, Penn.	2.00
Gray Summit and Klondike, Mo.	1.75@ 2.00
Klondike, Mo.	2.00
Los Angeles, Calif.—Washed	5.00
Massillon, Ohio	3.00
Mendota, Va.	2.25@ 2.50
Michigan City, Ind.	.35
Mineral Ridge and Ohlton, Ohio	2.50
Oceanside, Calif.	3.00
Ohlton, Ohio	2.50
Ottawa, Ill.	1.25
Pittsburgh, Penn.	3.00@ 4.00
Red Wing, Minn.	1.50
Rockwood, Mich.	2.75@ 3.25
Round Top, Md.	2.00
San Francisco, Calif.	4.00@ 5.00
Silica, Va.	2.00@ 2.50
St. Louis, Mo.	2.00
Sewanee, Tenn.	1.50
Utica and Ottawa, Ill.	.75@ 1.00
Zanesville, Ohio	2.50

Miscellaneous Sands

City or shipping point	Roofing sand	Traction
Beach City, Ohio		1.75
Chippewa Falls, Wis.		.25*

(Continued on next page)

Wholesale Prices of Sand and Gravel

Prices given are per ton, F.O.B., producing plant or nearest shipping point

Washed Sand and Gravel

City or shipping point	Fine Sand, 1/10 in. down	Sand, ¼ in. and less	Gravel, ½ in. and less	Gravel, 1 in. and less	Gravel, 1½ in. and less	Gravel, 2 in. and less
EASTERN:						
Asbury Park, Farmingdale, Spring Lake and Wayside, N.J.	.65	.55	1.00	1.35	1.40	
Attica and Franklinville, N. Y.	.75	.75	.75	.75	.75	.75
Boston, Mass.‡	1.40	1.40	2.25		2.25	2.25
Buffalo, N. Y.	1.10	1.05	1.05	1.05		1.05
Erie, Penn.	.60				1.40	
Machias Jct., N. Y.	.85	.65	.65		.65	.65
Montoursville, Penn.	1.00	.85	.75	.75	.75	.75
Northern New Jersey	.50@ .90	.50@ .90		1.25	1.25	1.25
Portland, Me.	1.00	1.00	2.50		2.25	
Somerset, Penn.		2.00				
Washington, D. C.	.60@ .75	.60@ .75	1.70	1.50	1.30	1.30
CENTRAL:						
Attica, Ind.			All sizes .75@.85			
Aurora, Moronts, Oregon, Sheridan, Yorkville, Ill.	.25@ .80	.50@ .70	.10@ .40	.50@ .70	.60@ .80	.60@ .80
Barton, Wis.		.55	.75	.75	.75	.75
Columbus, Ohio		.85	.85	.85	.85	
Des Moines, Iowa		.30	1.30	1.30	1.30	1.30
Eau Claire, Chippewa Falls, Wis.		.50	.20		.95	
Elkhart Lake, Wis.		.50	.50	.60	.50	.60
Ferrysburg, Mich.		.50@ .80	.60@1.00	.60@1.00		.50@1.25
Grand Haven, Mich.		.60@ .80	.70@ .90	.70@ .90		.70@ .90
Grand Rapids, Mich.	.50	.50	.90	.80	.70	.70
Hamilton, Ohio	1.00	1.00	1.00		1.00	
Hersey, Mich.		.50		.70		.70
Humboldt, Iowa	.35@ .50	.35@ .50	1.35@1.50	1.35@1.50	1.35@1.50	1.35@1.50
Indianapolis, Ind.	.60	.60		.90	.75@1.00	.75@1.00
Mankato, Minn.		.45		1.25	1.25	1.25
Mattoon, Ill.			.75@.85 all sizes			
Milwaukee, Wis.	.96	.91	1.06	1.06	1.06	1.06
Minneapolis, Minn.	.65*	.65*	1.75*	1.75*	1.75*	1.75*
St. Louis, Mo.	1.20e	1.45f	1.55a	1.45	1.45	1.45
St. Paul, Minn.	.35	.35	1.25	1.25	1.25	1.25
Terre Haute, Ind.	.85	.85	.85	.85	.85	.85
Waukesha, Wis.		.45	.60	.60	.65	.65
Winona, Minn.	.40	.40	1.50	1.25	1.25	1.15
SOUTHERN:						
Brewster, Fla.	.45	.45	3.00			
Brookhaven, Miss.	1.25	.70	1.25	1.00	.70	.70
Charleston, W. Va.			River sand and gravel, all sizes, 1.40			
Eustis, Fla.		.50				
Ft. Worth, Texas						.85
Knoxville, Tenn.	1.00	1.00	1.20	1.20	1.20	1.20
New Martinsville, W. Va.	1.00	.90@1.00		1.30@1.40		.80@ .90
Roseland, La.	.25	.15	1.25	.85	.45@ .65	
WESTERN:						
Kansas City, Mo.	.70	.70@ .75				
Crushton, Durbin, Kincaid, Largo, Rivas, Calif.	.10@ .40	.10@ .40	.50@1.00	.50@1.00	.50@1.00	.50@1.00
Oregon City, Ore.	1.25*	1.25*	1.25*	1.25*	1.25*	1.25*
Phoenix, Ariz.	1.25	1.00	1.50	1.25	1.10	1.00
Pueblo, Colo.	.80	.60		1.20		1.15
San Diego, Calif.		.40@ .50	.80@1.00	.80@1.00	.65@ .80	.65@ .80
Seattle, Wash.	1.00	1.00	1.00	1.00	1.00	1.00
Steilacoom, Wash.	.50	.50	.50	.50	.50	.50

Bank Run Sand and Gravel

City or shipping point	Fine Sand, 1/10 in. down	Sand, ¼ in. and less	Gravel, ½ in. and less	Gravel, 1 in. and less	Gravel, 1½ in. and less	Gravel, 2 in. and less
Algonquin and Beloit, Wis.			Dust to 3 in., .40			
Brookhaven, Miss.						.60
Buffalo, N. Y.	1.10	.95		.85		.85
Des Moines, Iowa	.50					
Dresdon, Ohio	.60@ .75	.70	.60	.80	.75	.65
East Hartford, Conn.	.85*d					
Eau Claire, Chippewa Fls., Wis					.65	
Ft. Worth, Texas						.85
Gainesville, Texas						.55
Grand Rapids, Mich.				.50		
Hamilton, Ohio					1.00	
Hersey, Mich.				.50		
Indianapolis, Ind.			Mixed gravel for concrete work, at .65			
Macon, Ga.	.50	.50				
Mankato, Minn.	.30					
Moline, Ill. (b)	.60	.60	Concrete gravel, 50% G., 50% S., 1.00			
Oregon City, Ore.	1.25*	1.25*	1.25*	1.25*	1.25*	1.25*
Somerset, Penn.		1.85@2.00		1.50@1.75		
Steilacoom, Wash.	.25					
St. Louis, Mo.			Mine run gravel, 1.55 per ton			
Summit Grove, Ind.	.50	.50	.50	.50	.50	.54
Winona, Minn.	.60	.60	.60	.60	.60	.60
York, Penn.	1.10	1.00				

*Cubic yd. ‡Delivered on job by truck. (a) ⅝-in. down. (b) River run. (c) 2½-in. and less ¶By truck only. (d) Delivered in Hartford, Conn., $1.50 per yd. (e) Mississippi River. (f) Meramec River.

Core and Foundry Sands

Silica sand is quoted washed, dried and screened unless otherwise stated. Prices per ton f.o.b. producing plant.

City or shipping point	Molding, fine	Molding, coarse	Molding, brass	Core	Furnace lining	Sand blast	Stone sawing
Aetna, Ill.				.30@ .35			
Albany, N. Y.	2.75	2.75	2.75	1.00@2.75		1.75@4.50	
Arenzville, Ill.	1.50@1.75			1.00			
Beach City, Ohio	1.75@2.00	1.75@2.00		1.75	1.75@2.00		
Buffalo, N. Y.	1.50	1.50		2.00@2.50			
Cedarville and S. Vineland, N. J.				2.25			
Columbus, Ohio	1.50@2.00	1.25@1.50	2.00	.30	1.75@2.00	2.75@4.50	
Dresden, Ohio	1.50@1.75	1.25@1.50	1.50@1.75	1.25			
Eau Claire, Wis.						3.00	
Elco & Tamms, Ill.	Ground silica per ton in carloads—18.00@31.00						
Estill Springs and Sewanee, Tenn.	1.25			1.25		1.35@1.50	
Franklin, Penn.	1.75	1.75		1.75			
Kasota, Minn.							1.00
Kerrs, Ohio	1.10@1.50	1.25@2.00	2.00			2.75@3.00	
Klondike, Mo.				2.00	2.00		2.00
Massillon, Ohio	2.25	2.25		2.50	2.50		
Mendota, Va.	Ground flint or silex—16.00@20.00 per ton						
Michigan City, Ind.				.30@ .35			
Millville, N. J.				1.75b		3.50	
Montoursville, Penn.				1.35@1.50			
New Lexington, O.	1.75	1.25					
Ohlton, Ohio	1.75b	1.75b		2.00b	1.75b	1.75b	
Ottawa, Ill.						3.50	
Red Wing, Minn.(d)					1.50	3.00	1.50
Round Top, Md.				1.60		2.25	
San Francisco, Calif.[1]	3.50†	5.00†	3.50†	3.50@5.00†	3.50@5.00†	3.50@5.00†	
Silica, Va.	Potters' flint, 7.00@12.00						
Utica & Ottawa, Ill.	.40@1.00f	40.@1.00f	.75@1.00	.40@1.00f	.60@1.00f	2.23@3.25	1.00@3.25
Utica, Ill.	.60	.70		.75	1.00		
Utica, Penn.	1.75	1.75		2.00			
Warwick, Ohio	1.50*2.00	1.50*@2.00	1.75	1.50*@2.00	1.50*@2.00		
Zanesville, Ohio	2.00	1.50	2.00	2.00	2.00		

*Green. †Fresh water washed, steam dried. [1]Core, washed and dried, 2.50. (b) Damp. (c) Shipped from Albany. (d) Filter sand, 3.00. (e) Filter sand, 3.00@4.25. (f) Crude and dry.

Crushed Slag

City or shipping point	Roofing	¼ in. down	½ in. and less	¾ in. and less	1½ in. and less	2½ in. and less	3 in. and larger
EASTERN:							
Buffalo, N. Y., Erie and Dubois, Pa.	2.25	1.25	1.25	1.35	1.25	1.25	1.25
Eastern Penn.	2.50	1.20	1.50	1.20	1.20	1.20	1.20
Northern N. J.	2.50	1.20	1.50	1.20	1.20	1.20	1.20
Reading, Penn.	2.50	1.25		1.50			
Western Penn.	2.50	1.25	1.50	1.25	1.25	1.25	1.25
CENTRAL:							
Ironton, Ohio	2.05*	1.30*	1.80*	1.45*	1.45*	1.45*	
Jackson, Ohio	2.05*	1.05*	1.80*	1.30*	1.05*	1.30*	
Toledo, Ohio	1.50	1.35	1.35	1.35	1.35	1.35	1.35
Youngst'n, O., dist.	2.00	1.25	1.35	1.35	1.25	1.25	1.25
SOUTHERN:							
Ashland, Ky.		1.45*		1.45*	1.45*	1.45*	
Ensley and Alabama City, Ala.	2.05	.80	1.35	1.25	.90	.90	.80
Longdale, Roanoke, Ruesens, Va.	2.50	1.00	1.25	1.25	1.25	1.15	1.15
Woodward, Ala.	2.05*	.80*	1.35*	1.25*	.90*	.90*	

*5c per ton discount on terms.

Lime Products (Carload Prices Per Ton F.O.B. Shipping Point)

	Finishing hydrate	Masons' hydrate	Agricultural hydrate	Chemical hydrate	Ground burnt lime, Blk.	Ground burnt lime, Bags	Lump lime, Blk.	Lump lime, Bbl.
EASTERN:								
Berkeley, R. I.			12.00					2.00
Buffalo, N. Y.		12.00	12.00	12.00			10.00	1.95[4]
Chazy, N. Y.		8.50	7.50	10.00		15.50[1]	8.50	14.00
Lime Ridge, Penn.					5.00[2]			
Pittsburgh, Penn.	11.50	8.50	8.50		9.00	11.00	8.00	
West Stockbridge, Mass.	12.00	10.00	5.60					2.00[13]
Williamsport, Penn.			10.00				6.00	
York, Penn., & Oranda, Va.	11.50[7]	8.50@9.50[7]	8.50@9.50[7]	8.50@10.50[7]	8.00	9.25	7.00	1.40[8]
CENTRAL:								
Afton, Mich.							7.80	1.35
Carey, Ohio	11.50	7.50	7.50		9.00		8.00	1.50
Cold Springs, Ohio		8.50	8.50				8.00	
Cold Springs and Gibsonburg, Ohio	11.50	8.50	8.50		9.00	11.00		
Huntington, Ind.	12.50	8.50	8.50		9.00		8.00	
Luckey, Ohio[9]	11.50							
Milltown, Ind.		8.50@10.00		10.00[3]			8.50[22]	1.35[10]
Scioto and Marble Cliff, O.		8.50	8.50	9.50	8.25	.62½	7.50	1.50[3]
Sheboygan, Wis.		10.50					9.50	2.00[4]
Wisconsin points[6]		11.50					9.50	
Woodville, Ohio	11.50	8.50	8.50	12.50	8.00	10.00[9]	9.00	1.50[3]
SOUTHERN:								
Allgood, Ala.	12.50	10.00			8.50		8.50	1.50
El Paso, Texas							7.00	1.50
Frederick, Md.		9.00	9.00	9.50	7.50	9.00	7.50	9.00
Graystone, Ala.	12.50	10.00		12.50		1.40[14]	8.50	1.50
Keystone, Ala.		10.00	8.00	10.00	8.00		8.00	1.50
Knoxville, Tenn.	20.25	8.50	8.50	8.50			7.50	1.25
Ocala, Fla.	14.00	12.00	11.50	12.00			11.50	1.60
Saginaw, Ala.	12.50	10.00	9.00	10.00			8.50	1.50
WESTERN:								
Kirtland, N. M.							15.00	
Limestone, Wash.	15.00	15.00	10.00	15.00	16.50	16.50	16.50	2.09
Los Angeles, Calif.	16.00		16.00	16.00			16.00	
San Francisco, Calif.	20.00	20.00	13.50	21.00			14.50[20]	2.15
Tehachapi, Calif.[13]	17.00	15.00	12.00@15.00[11]	17.00	16.00		16.00	2.00
Seattle, Wash.	19.00	19.00	12.00	19.00	19.00		18.60	2.30

[1] Barrels. [2] Net ton. [3] Wooden, steel 1.70. [4] Steel. [5] 180 lb. [6] Dealers' prices, net 30 days less 25c discount per ton on hydrated lime and 5c per bbl. on lump if paid in 10 days. [7] In paper bags, including bags. [8] To 11.00. [9] 80-lb. [10] To 1.50. [11] Refuse or air slack, 10.00@12.00. [12] To 3.00. [13] Delivered in Southern California. [14] Per 2 bags of 90 lb. each. [22] To 9.00. [20] To 16.50.

Miscellaneous Sands

(Continued)

City or shipping point	Roofing Sand	Traction
Columbus, Ohio		.15@ .30
Dresden, Ohio		1.25
Eau Claire, Wis.	4.25	
Estill Springs and Sewanee, Tenn.	1.35@ 1.50	1.35@ 1.50
Massillon, Ohio		2.00
Michigan City, Ind.		.30
Montoursville, Penn.		1.10
Ohlton, Ohio	*1.75@ 2.00	*1.75
Red Wing, Minn.		1.00
Round Top, Md.	2.25	1.75
San Francisco, Calif.	3.50	3.50
Utica & Ottawa, Ill.	1.00@ 3.25	.75
Warwick, Ohio		2.00
Zanesville, Ohio		2.50

*Damp.

Talc

Prices given are per ton f.o.b. (in carload lots only), producing plant, or nearest shipping point.

Baltimore, Md.:	
Crude talc (mine run)	3.00@ 4.00
Ground talc (20-50 mesh), bags	10.00
Cubes	55.00
Blanks (per lb.)	.08
Pencils and steel crayons, gross	1.00@ 2.80
Chatsworth, Ga.:	
Crude talc, grinding	5.00
Ground talc (20-50 mesh), bags	9.00
Ground talc (150-200 mesh)	10.00
Pencils and steel crayons, per gross	1.50@ 2.50
Chester, Vt.:	
Ground talc (150-200 mesh), paper bags	9.00@10.00
Same, burlap bags, bags extra	8.00@ 9.00
Chicago and Joliet, Ill.:	
Ground (150-200 mesh), bags	30.00
Dalton, Ga.:	
Crude talc (for grinding)	5.00
Ground talc (150-200 mesh), bags	12.00
Pencils and steel worker's crayons, per gross	1.00@ 2.50
Emeryville, N. Y.:	
(Double air floated) including bags;	
325 mesh	14.75
200 mesh	13.75
Glendon, N. C.:	
Ground talc (150-200 mesh), bulk	6.00@10.00
Ground talc (150-200 mesh), bags	8.00@14.00
Pencils and steel crayons, gross	1.05@ 2.00
Blanks, .08 per lb.; cubes	50.00
Hailesboro, N. Y.:	
Ground white talc (double and triple air floated) 200-lb. bags, 300-350-mesh	15.50@20.00
Henry, Va.:	
Crude (mine run)	3.50@ 4.50
Ground talc (150-200 mesh), bags	8.00@14.50
Joliet, Ill.:	
Ground talc (200 mesh, grey), bags	10.00
Ground talc (200 mesh, white), bags	20.00
Keeler, Calif.:	
Ground (200-300 mesh), bags	20.00@30.00
Natural Bridge, N. Y.:	
Ground talc (300-325 mesh), bags	12.00@15.00

Rock Phosphate

Prices given are per ton (2240-lb.) f.o.b. producing plant or nearest shipping point.

Lump Rock

Columbia, Tenn.—B.P.L. 65-70%	3.50@ 4.50
Gordonsburg, Tenn.—B.P.L. 65-68%	3.75@ 4.25
Mt. Pleasant, Tenn.—B.P.L. 72%	5.00@ 5.50
Tennessee — F.o.b. mines, gross ton, unground brown rock, B.P.L. 72%	5.00
B.P.L. 75%	6.00
Twomey, Tenn.—B.P.L. 65%, 2000 lb.	8.00@ 9.00

Ground Rock

(2000 lb.)

Centerville, Tenn.—B.P.L. 65%	8.00
Gordonsburg, Tenn.—B.P.L. 65-70%	4.00@ 4.50
Mt. Pleasant, Tenn.—B.P.L. 72.5%	9.50
Twomey, Tenn.—B.P.L. 65%	8.00@ 9.00

Florida Phosphate

(Raw Land Pebble)

(Per Ton)

Florida — F.o.b mines, gross ton, 68/66% B.P.L., Basis 68%	3.25
70% min. B.P.L., Basis 70%	3.75

Mica

Prices given are net, f.o.b. plant or nearest shipping point.

Pringle, S. D.—Mine run, per ton	125.00
Punch mica, per lb.	.06
Scrap, per ton, carloads	20.00
Rumney Depot, N. H.—Per ton,	
Mine run	300.00
Clean shop scrap	25.00
Mine scrap	22.50@24.00
Roofing mica	37.50
Punch mica, per lb.	.12
Cut mica—50% from Standard List.	

Special Aggregates

Prices are per ton f.o.b. quarry or nearest shipping point.

City or shipping point	Terrazzo	Stucco-chips
Brandon, Vt. — English pink, English cream and coral pink	*12.50	*12.50
Brandon grey	*12.50	*12.50
Brighton, Tenn.—Pink marble chips	§3.00	§3.00
Crown Point, N. Y.—Mica spar		9.00@10.00
Easton, Penn.—Green stucco		12.00@18.00
Green granite		14.00@20.00
Harrisonburg, Va.—Bulk marble (crushed, in bags)	†12.50	†12.50
Ingomar, Ohio—Concrete facings and stucco dash		8.00@16.00
Middlebrook, Mo.—Red		20.00@25.00
Middlebury, Vt.—Middlebury white	‡9.00	‡9.00
Middlebury and Brandon, Vt.—Caststone, per ton, including bags		5.50@ 7.50
Phillipsburg, N. J.—Royal green granite		15.00@18.00
Randville, Mich.—Crystalite crushed white marble, bulk	4.00	4.00@ 7.00
Rose pink granite, bulk		12.00
Stockton, Calif.—"Natrock" roofing grits		12.00@18.00
Tuckahoe, N. Y.—Tuckahoe white	12.00	
Wauwatosa, Wis.		20.00@32.00
Wellsville, Colo. — Colorado Travertine Stone	15.00	15.00

*Carloads, including bags; L.C.L. 14.50.
†C.L. L.C.L. 16.00.
‡Carloads, including bags; L.C.L. 10.00.
¶Bulk, car lots, minimum 30 tons.

Potash Feldspar

Auburn and Topsham, Me. — Color white, 98% thru 140-mesh	19.00
Buckingham, Ore.—White, analysis, K_2O, 12-13%; Na_2O, 1.75%; bulk	9.00
De Kalb Jct., N. Y.—Color, white, bulk (crude)	9.00
East Hartford, Conn.—Color, white, 95% thru 60 mesh, bags	16.00
96% thru 150 mesh, bags	28.00
East Liverpool, Ohio—Color, white; 98% thru 200 mesh, bulk	19.35
Soda feldspar, crude, bulk, per ton	22.00
Glen Tay Station, Ont.—Color, red or pink; analysis, K_2O, 12.81%; crude	7.00
Keystone, S. D.—White; bulk (crude)	8.00
Los Angeles, Calif.—Color, white; analysis, K_2O, 12.16%; Na_2O, 1.53%; SiO_2, 65.60%; Fe_2O_3, .10%; Al_2O_3, 19.20%; crude, bags, 10.00@12.00; bulk	9.00@11.50
Pulverized, 95% thru 200 mesh; bags, 19.73@22.00; bulk	15.83@20.00
Murphysboro, Ill.—Color, prime white; analysis, K_2O, 12.60%; Na_2O, 2.35%; SiO_2, 63%; Fe_2O_3, .06%; Al_2O_3, 18.20%; 98% thru 200 mesh; bags, 21.00; bulk	20.00
Penland, N. C.—White; crude, bulk	8.00
Ground, bulk	16.50
Spruce Pine, N. C.—Color, white; analysis, K_2O, 10%; Na_2O, 3%; Si_2O, 68%; Fe_2O_3, 0.10%; Al_2O_3, 18%; 99½% thru 200 mesh; bulk	18.00
Crude	9.00
Tenn. Mills—Color, white; analysis K_2O, 10%; Na_2O_3, 3%; 68% SiO_3; 99½% thru 200 mesh; bulk (Bags, 15c extra)	18.00
Toronto, Can.—Color, flesh; analysis K_2O, 12.75%; Na_2O, 1.96%; crude	7.50@ 8.00

Chicken Grits

Afton, Mich. (Limestone), per ton	1.75
Belfast, Me.—(Limestone), per ton	‡10.00
Brandon, Vt.	10.00
Cartersville, Ga.—(Limestone), per bag	2.25
Centerville, Iowa—(Gypsum), per ton	18.00
Chico and Bridgeport, Tex.—Hen	¶9.00
Baby chick, per ton	¶8.00
Danbury, Conn.—(Limestone), bulk	‡7.50@*9.00
Easton, Penn.—Per ton, bulk	3.00
El Paso, Tex.—Per ton	1.00
Joliet, Ill.—(Limestone), bags, per ton	4.50
Knoxville, Tenn.—Per bag	1.25
Los Angeles, Calif.—(Feldspar), per ton	15.00
Gypsum, Ohio—(Gypsum), per ton	10.00
Hartford, Conn.	‡7.50@*9.00
Limestone, Wash. — (Limestone), per ton	12.50
Los Angeles, Calif. (including sacks)	12.00
Marion, Va.—(Limestone), bulk, 5.00; bagged, 6.50; 100-lb. bag	.50
Middlebury, Vt.—Per ton	10.00
Rocky Point, Va.—(Limestone), 100-lb. bags, 50c; sacks, per ton, 6.00; bulk	5.00
Seattle, Wash.—(Limestone), bulk, per ton	10.00
Warren, N. H.—(Mica), per ton	3.85@ 3.90
Waukesha, Wis.—(Limestone), per ton	8.00
West Stockbridge, Mass.—(Limestone), bulk	‡7.50@*9.00
Wisconsin Points—(Limestone), per ton	15.00

*L.C.L. †Less than 5-ton lots. ‡C.L. ¶100-lb. bags.

Sand-Lime Brick

Prices given per 1000 brick f.o.b. plant or nearest shipping point, unless otherwise noted.

Albany, Ga.	10.00
Anaheim, Calif.	10.50@11.00
Barton, Wis.	10.50
Boston, Mass.	17.00*
Brighton, N. Y.	19.75*
Brownstone, Penn.	11.00
Dayton, Ohio	12.50@13.50
Detroit, Mich.	13.00@14.00
Farmington, Conn.	13.00
Flint, Mich.	¶12.00@17.50*
Grand Rapids, Mich.	12.50
Hartford, Conn.	14.00@19.00*
Jackson, Mich.	12.25
Lakeland, Fla.	10.00@11.00
Lake Helen, Fla.	9.00@12.00
Lancaster, N. Y.	12.25
Madison, Wis.	12.50a
Michigan City, Ind.	11.00
Milwaukee, Wis.	13.00*
Minneapolis, Minn.	10.00
New Brighton, Minn.	10.00
Pontiac, Mich.	16.00*
Portage, Wis.	16.00
Prairie du Chien, Wis.	18.00@22.50
Rochester, N. Y.	19.75
Saginaw, Mich.	13.50
San Antonio, Texas	16.00
Sebewaing, Mich.	12.50
Sioux Falls, S. Dak.	13.00
South River, N. J.	13.00
Syracuse, N. Y.	16.00@18.00
Toronto, Canada	13.50@16.00*†
Wilkinson, Fla.	12.00@16.00
Winnipeg, Canada	14.00

*Delivered on job. †5% disc., 10 days. ¶Dealers' price. (a) Less 50c discount per M, 10 days.

Portland Cement

Prices per bag and per bbl., without bags, net in carload lots.

	Per Bag	Per Bbl.
Albuquerque, N. M.	.86¾	3.47
Atlanta, Ga.		2.35
Baltimore, Md.		2.15@2.25
Birmingham, Ala.		2.10
Boston, Mass.		2.13@2.23
Buffalo, N. Y.		2.10@2.30
Butte, Mont.	.90¼	3.61
Cedar Rapids, Iowa		2.24
Charleston, S. C.		2.35
Cheyenne, Wyo.	.82¼	3.31
Cincinnati, Ohio		2.22
Cleveland, Ohio		2.24
Chicago, Ill.	.51¼	2.05
Columbus, Ohio	.37¼	2.29
Concrete, Wash.		2.35
Dallas, Texas		2.00
Davenport, Calif.		2.45*
Davenport, Iowa		2.24
Dayton, Ohio	.58¼	2.33
Denver, Colo.	.66¼	2.65
Des Moines, Iowa		2.05
Detroit, Mich.		1.90
Duluth, Minn.		2.04
Houston, Texas		2.00
Indianapolis, Ind.	.54¼	2.19
Jackson, Miss.		2.30
Jacksonville, Fla.		2.20
Jersey City, N. J.		2.03@2.13
Kansas City, Mo.		1.92
Los Angeles, Calif.	.60	2.40
Louisville, Ky.	.55½	2.22
Memphis, Tenn.		2.10
Milwaukee, Wis.		2.00@2.20
Minneapolis, Minn.		2.12@2.22
Montreal, Que.		1.36
New Orleans, La.		2.07
New York, N. Y.		1.93@2.03
Norfolk, Va.		2.07
Oklahoma City, Okla.		2.46
Omaha, Neb.		2.36
Peoria, Ill.		2.22
Philadelphia, Penn.		2.11@2.21
Phoenix, Ariz.		3.26
Pittsburgh, Penn.		2.04
Portland, Colo.		2.80
Portland, Ore.		2.70‡
Reno, Nev.		2.91
Richmond, Va.		2.24@2.34
Salt Lake City, Utah	.70¼	2.81
San Francisco, Calif.		2.21
Savannah, Ga.		2.30
St. Louis, Mo.	.51¼	2.05
St. Paul, Minn.		2.12@2.22
Seattle, Wash.		2.50†@2.65
Tampa, Fla.		2.25
Toledo, Ohio		2.20
Topeka, Kan.		2.41
Tulsa, Okla.		2.33
Wheeling, W. Va.		2.12
Winston-Salem, N. C.		2.44

Mill prices f.o.b. in carload lots, without bags, to contractors.

	Per Bag	Per Bbl.
Albany, N. Y.	.43¾	1.75
Buffington, Ind.		1.80
Chattanooga, Tenn.		2.45*
Concrete, Wash.		2.35
Davenport, Calif.		2.45*
Detroit, Mich.		2.15
Hannibal, Mo.		1.90
Hudson, N. Y.		1.75
Leeds, Ala.		1.65
Lime and Oswego, Ore.		2.70‡
Mildred, Kan.		2.35
Nazareth, Penn.		2.15
Northampton, Penn.		1.75
Richard City, Tenn.		2.05
Steelton, Minn.		1.85
Toledo, Ohio		2.20
Universal, Penn.		1.90

NOTE—Add 40c per bbl. for bags.
*Includes sacks.
†10c discount, 10 days. ‡10c discount, 15 days.

Gypsum Products—CARLOAD PRICES PER TON AND PER M SQUARE FEET, F.O.B. MILL

	Crushed Rock	Ground Gypsum	Agricultural Gypsum	Stucco Calcined Gypsum	Cement and Gauging Plaster	Wood Fiber	Gauging White	Plaster Sanded	Cement Keene's	Finish Trowel	—Plaster Board— ¾x32x 36". Per M Sq. Ft.	¾x32x 36". Per M Sq. Ft.	Wallboard, ⅜x32 or 48". Lengths 6'-10'. Per M Sq. Ft.
Arden, Nev., and Los Angeles, Calif.	3.00	8.00u	8.00u	10.70u	10.70u					11.70u			
Centerville, Iowa	3.00	10.00	15.00	10.00	10.00	10.50	13.50			13.50			
Des Moines, Iowa	3.00	8.00	9.00	10.00	10.00	10.50	13.50	12.00	24.00	22.00	18.00	21.00	30.00
Detroit, Mich.					14.30o	12.30m		m9.00@11.00o					
Delawanna, N. J.						12.50		8.25			14.00	15.00	33.61
Douglas, Ariz.			6.00	14.50	15.00		18.00		30.00				
Grand Rapids, Mich.	2.75	6.00	6.00	8.00	9.00	9.00	17.50		24.35	20.00			
Gypsum, Ohio	3.00	4.00	6.00	7.00	9.00	9.00	18.00	7.00	27.50	19.00			
Los Angeles, Calif.			7.50@9.50	11.50y									
Port Clinton, Ohio	3.00	4.00	6.00	10.00	9.00	9.00	21.00	7.00	30.15	20.00		20.00	30.00
Portland, Colo.				10.00									
San Francisco, Calif.			9.00	13.40	14.40		15.40						
Seattle, Wash.	6.60	10.00	10.00	13.00									
Sigurd, Utah									21.50				
Winnipeg, Man.	5.00	5.00	7.00	13.00	14.00	14.00					20.00	25.00	33.00

NOTE—Returnable bags, 10c each; paper bags, 1.00 per ton extra (not returnable).
(m) Includes paper bags; (o) includes jute sacks; (u) includes sacks; (y) sacks 15c extra, rebated.

Market Prices of Cement Products

Concrete Block

Prices given are net per unit, f.o.b. plant or nearest shipping point

City or shipping point	Sizes 8x8x16	8x10x16	8x12x16
Camden, N. J.	17.00	.....	.....
Cement City, Mich.		5x8x12—55.00¶	
Columbus, Ohio	16.00	.....	.....
Detroit, Mich. (d)	.16	.....	.18
Forest Park, Ill.	21.00*	.....	.....
Grand Rapids, Mich.	15.00*	.....	.....
Graettinger, Iowa	.16@ .18	.....	.....
Indianapolis, Ind	.10@ .12a	.....	.....
Los Angeles, Calif.	4x8x12—5.00*	4x6x12—4.20*	
Oak Park, Ill.	20.00	.....	.....
Olivia and Mankato, Minn.	9.50b	.....	.....
Somerset, Penn.	.18@ .20	.....	.....
Tiskilwa, Ill.	.16@ .18†	.....	.....
Yakima, Wash.	20.00*	.....	.....

*Price per 100 at plant. †Rock or panel face. (a) Face. ‡Delivered. ¶Price per 1000. (b) Per ton. (c) Plain. (d) 5x8x12—65.00 M, 5½x8x12—68.50 M.

Cement Roofing Tile

Prices are net per sq. in. carload lots, f.o.b. nearest shipping point, unless otherwise stated.

Camden and Trenton, N. J.—8x12, per sq.

Red	15.00
Green	18.00
Chicago, Ill.—Per sq.	20.00

Cicero, Ill.—Hawthorne roofing tile, per sq.

	Chocolate, Red, Yellow, Gray, and Orange	Green, Blue
French and Spanish†	$11.50	$13.50
Ridges (each)	.25	.35
Hips	.25	.35
Hip starters	.50	.60
Hip terminals, 2-way	1.25	1.50
Hip terminals, 4-way	4.00	5.00
Mansard terminals	2.50	3.00
Gable finials	1.25	1.50
Gable starters	.25	.35
Gable finishers	.25	.35

†Price per square.

Houston, Texas—Roofing Tile, per sq.	25.00
Indianapolis, Ind.—9x15-in.	Per sq.
Gray	10.00
Red	11.00
Green	13.00
Waco, Texas:	Per sq.
4x4	.60

Cement Building Tile

Cement City, Mich.:	Per 100
5x8x12	5.00
Columbus, Ohio:	
5x8x12	6.50
Grand Rapids, Mich.:	
5x8x12	8.00
Longview, Wash.:	
4x6x12	5.00
4x8x12	6.25
Mt. Pleasant, N. Y.:	Per 100
5x8x12	78.00
Houston, Texas:	
5x8x12 (Lightweight)	80.00
Pasadena, Calif. (Stone Tile):	Per 100
3½x4x12	3.00
3½x6x12	4.00
3½x8x12	5.50
Tiskilwa, Ill.:	Per 100
8x8	15.00
Wildasin Spur, Los Angeles, Calif. (Stone-Tile):	Per 1000
3½x6x12	50.00
3½x8x12	60.00
Prairie du Chien, Wis.:	
5x8x12	82.00
5x4x12	46.00
5x8x 6 (half-tile)	41.00
5x8x10 (fractional)	82.00
Yakima, Wash. (Building Tile):	
5x8x12	.10

Cement Drain Tile

Graettinger, Iowa.—Drain tile, per foot: 5-in., .04½; 6-in., .05½; 8-in., .09; 10-in., .13; 12-in., .17½; 14-in., .25; 16-in., .32; 18-in., .40; 20-in., .50; 24-in., .80; 26-in., 1.00; 28-in., 1.10; 30-in.	1.25
Longview, Wash.—Drain tile, per foot: 3-in., .05; 4-in., .06; 6-in., .10; 8-in., .15; 10-in.	.20
Olivia and Mankato, Minn.—Cement drain tile, per ton	8.00
Tacoma, Wash.—Drain tile, per ft.:	
3 in	.04
4 in	.05
6 in	.07½
8 in	.10
Waukesha, Wis.—Drain tile, per ton	8.00

Concrete Brick

Prices given per 1000 brick, f.o.b. plant or nearest shipping point.

	Common	Face
Appleton, Minn.	22.00	25.00@40.00
Baltimore, Md. (Del. according to quantity)	15.50	22.00@50.00
Camden and Trenton, N. J.	17.00	.....
Columbus, Ohio	16.00	17.00
Ensley, Ala. ("Slagtex")	14.50	22.50@33.50
Eugene, Ore.	25.00	35.00@75.00
Forest Park, Ill.	.....	37.00
Friesland, Wis.	22.00	32.00
Longview, Wash.*	15.00	22.50@65.00
Milwaukee, Wis.	14.00	25.00@30.00
Mt. Pleasant, N. Y.	.....	14.00@23.00
Oak Park, Ill.	.....	42.00
Omaha, Neb.	18.00	30.00@ 40.00
Pasadena, Calif.	10.00	.....
Philadelphia, Penn.	14.75	20.00
Portland, Ore.	17.50	23.00@55.00
Mantel brick—100.00@150.00		
Prairie du Chien, Wis.	14.00	22.50@ 25.00
Rapid City, S. D.	17.00	25.00@ 35.00
Waco, Texas	16.50	32.50@125.00
Watertown, N. Y.	20.00	35.00
Westmoreland Wharves, Penn.	14.75	20.00
Winnipeg, Man.	14.00	22.00
Yakima, Wash.	22.50	.....

*40% off List.

Current Prices Cement Pipe

Prices are net per foot f.o.b. cities or nearest shipping point in carload lots unless otherwise noted

Culvert and Sewer	4 in.	6 in.	8 in.	10 in.	12 in.	15 in.	18 in.	20 in.	22 in.	24 in.	27 in.	30 in.	36 in.	42 in.	48 in.	54 in.	60 in.
Detroit, Mich.								15.00 per ton									
Grand Rapids, Mich.		4 in. to 12 in., 72% off standard sewer price list; 15 in., 65% off; 18 in. to 24 in., 62% off; 27 in. to 36 in., 60% off															
Houston, Texas	.....	.19	.28	.43	.55½	.90	1.30	.....	1.70†	2.20	.....	.....	.....	.....	.....	.....	.....
Indianapolis, Ind. (a)	.....	.....	.....	.80	.90	1.10	1.30	.....	.....	1.70	.....	2.70	.....	.....	.....	.....	.....
Longview, Wash.								Sewer pipe 40% off list; culvert—list									
Mankato, Minn. (b)	.....	.....	.....	.....	.....	.....	.....	.....	.....	1.50	1.75	2.50	3.25	4.25	.....	.....	.....
Newark, N. J.								6 in. to 24 in., $18.00 per ton									
Norfolk, Neb. (b)	.....	.....	.....	.90	1.00	1.13	1.42	.....	.....	2.11	.....	2.75	3.58	.....	6.14	.....	7.78
Olivia, Mankato, Minn.								12.00 per ton									
Paullina, Iowa‡	.....	.....	.....	.....	.....	.....	.....	2.25	.....	2.11	.....	2.75	3.58	.....	6.14	.....	7.78
Somerset, Penn.	.....	.....	.....	.....	1.08	1.25	1.65	.....	.....	2.50	.....	3.65	4.85	7.50	8.50	.....	.....
Tiskilwa, Ill. (rein.)	.....	.....	.....	.75	.85	.95	1.20	1.70	.....	2.00	.....	2.75	3.40	.....	6.50	.....	.....
Wahoo, Neb. (b)	.....	.....	.....	.....	1.00	1.13	1.10	1.60	.....	1.90	.....	2.25	3.40	.....	5.50	.....	.....
Yakima, Wash.							1.42	.....	.....	2.11	.....	2.75	3.58	4.62	6.14	6.96	7.78
Tacoma, Wash.	.15	.18	.22½	.30	.40	.55	.75	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

(a) 24-in. lengths; (b) Reinforced.
†21-in. diam. ‡Price per 2-ft. length.

Contract Awarded for Drilling Two More Potash Test Wells

PRELIMINARY churn-drill operations have been completed at potash well No. 6, in Upton county, western Texas, and core drilling will begin immediately, according to the announcement of the United States Bureau of Mines, which has engineering supervision of drilling operations in the government's program for the development of commercial potash deposits in this country. Well No. 6, work on which began January 7, is located three miles north of McCamey, on a site designated by the U. S. Geological Survey as being favorable for exploration purposes. The top of the potash-bearing salts lies approximately 500 ft. beneath the surface. The probable depth of the hole will be about 1500 ft. A contract for this well and well No. 7 was awarded to the lowest bidder, the Pennsylvania Drilling Co. of Pittsburgh, Penn., and the company has made plans to start on the first part of the contract immediately.

After the completion of well No. 6, the drill will be removed to the site selected for well No. 7, in Upton county, about 10 miles north of McCamey, and approximately seven miles distant from the site of well No. 6. The top of the salt formation at the site of well No. 7 lies about 450 ft. below the surface. The depth of this hole will range from 1200 to 1500 ft. Samples taken from churn-drill sludges from oil wells drilled in the vicinity of wells 6 and 7 have shown the presence of potash salts. Both wells should be completed in the early spring. It is expected that at least one more test well can be drilled under the appropriation for the current year.

Potash test well No. 5, located on Harris Bros.' ranch in Crockett county, Texas, was completed December 2 at a depth of 1799 ft. 2 in. At this well the churn-drill was used to a depth of 1161 ft. 4 in., and the diamond drill used for the remaining 637 ft. 10 in. A perfect core recovery of 637 ft. 10 in. was obtained through the salt formation.

The cores from five previous test wells have been submitted by the Bureau of Mines to the U. S. Geological Survey for analysis and study. Results of the study of two of these cores have been announced by the Geological Survey, and the results of the study of the other three is expected to be announced in a short time.

Cement Products

TRADE MARK REGISTERED WITH U. S. PATENT OFFICE

Wisconsin Concrete Products Association Meets in Milwaukee

Proceedings and Abstracts of Papers Presented at Sixth Annual Meeting

AT the sixth annual convention of the Wisconsin Concrete Products Association, held at the new Schroeder Hotel in Milwaukee on February 2 and 3, there was brought together a group of manufacturers from at least six mid-western states. The emphasis of the papers presented centered on cost data for the industry, although in the round table discussion at the final session many operating features were discussed.

The convention was opened with an address of welcome in the name of the city of Milwaukee, by H. J. Bell, executive director of the Milwaukee Association of Commerce. L. E. Grube, of the Sheboygan Brick Co., Sheboygan, president of the association, thanked Mr. Bell for his greeting, and then briefly outlined the history and early struggles of the association which has in six years become a group of really national importance. He particularly welcomed members of the Iowa Concrete Products Association, who were holding their meeting with the Wisconsin group, as well as all other visitors from other states.

E. E. Sheasgreen, of the Standard Cost Finding Service Co., Minneapolis, Minn., presented the opening talk on "The Science of Square Dealing." He declared that the need of every business today is to come down to date and do away with the slow and unnecessary methods of previous times. The rules for successful operation are fundamentally the same, he said, no matter what the type of business. Truth, harmony and loyalty are the groundwork on which to build, and when we have these three, the other side of the square, service, is found automatically. Mr. Sheasgreen likened the cement products business to the human body, calling the officers and employes of a company the nervous system, and saying that the cost system forms the arteries, and the accounting systems, the veins of the body. The cost system and the accounting system must be interlocking to produce the only possible good results. He called attention to the fact that the Wisconsin plants are producing only about one-third of their capacity, according to the answers on questionnaires sent to the association members. Thus the investment

L. E. Grube, president, Wisconsin Concrete Products Association

in plant equipment is undoubtedly top-heavy. However, the solution is not in trying to take the business away from another products manufacturer, but it is to advertise and popularize cement products, so that they are used in place of brick, lumber and other competing materials.

A. W. Scheer, of the Best Block Co., Milwaukee, presented the first of four papers on operating problems in concrete products manufacture. He spoke on "Light-Weight Units," and he explained how his company was employed in the manufacture of haydite block. Haydite is an aggregate made from ground shale, burned in rotary kilns, about 75 ft. long, which resemble cement kilns, and then again crushed and ground. It is used in block with no other aggregate. Haydite is much lighter than ordinary sand, gravel or stone, weighing only 1400 to 1700 lb. per cubic foot, its lightness being due to its cellular formation. It is claimed that it produces blocks 20% to 25% greater in strength than other aggregates produce, but it is correspondingly higher in price. Besides lightness and strength, it is also claimed that haydite units produce a wall which is more nearly soundproof than the ordinary block wall. Mr. Scheer said that his company was using a mix of one-third sand-size haydite and two-thirds coarse haydite mixed for ten to twelve minutes.

How a State Law Helped Concrete Blocks

D. R. ("Spec") Collins, of A. W. Friske, Alois, Wis., vice-president of the National Concrete Products Association, presented a paper on "How a State Law Helped Concrete Building Units in Wisconsin," which will be read again at the meeting of the National Association in Philadelphia. He told of the early days when the state building code placed certain restrictions on concrete building units which practically eliminated them from consideration for public or industrial buildings. The manufacturers themselves were indifferent and were content to "get by" and not attempt to meet the state requirements, which limited the air space in units to 33% and the absorption to 10% of the dry weight. Finally a group of the manufacturers decided that the code must be changed and, with the aid of the Portland Cement Association and the

American Concrete Institute, a four-year fight was won and the units were permitted, provided they met strength tests. Testing laboratories were at once swamped by the number of specimens which they received, and the manufacturers, anxious to have their blocks used, produced grades easily passing tests. Mr. Collins continued:

Value of Clean Aggregates

"The new code made no mention of air space or void content, and the paragraphs relative to absorption made possible the use of cinders, slag or haydite as aggregate. It was not long before a lighter weight unit began to appear on the Wisconsin market. Where lightweight aggregate was not available concrete building units with thinner walls and a greater void, or air space, content appeared. More air space in the units called for better concrete and better concrete called for better manufacturing methods. The little group of pioneers who started the movement for a new code were ready for this and willing to pass on the results of their experience. It was surprising the number of so-called small plants who now rejected the bank run materials they had been using and demanded screened and cleaned materials. Sand and stone companies furnishing washed material were forced to create grades suitable for concrete products manufacture. Conversation about plants suddenly became more intelligent. 'Fineness modulus,' 'water-cement ratio,' 'time of mix,' suddenly became household words with even the average manufacturer. Many were greatly surprised at their reduction in breakage and the real savings that could be effected by using brains in manufacture.

"Best of all, it became known generally, among architects and builders, what was happening. They now had confidence in a material they had thought suitable only for basements under small frame dwellings. The concrete unit rose from the position of a despised material to that of an accepted article. One great and lasting good that interest in securing the new code has brought about is a welding together of manufacturers operating in all sections of the state. They are operating under a common law and meeting common requirements. They have common problems and are working them out together. Local codes are being changed to comply with the state code. They have achieved a unity of purpose."

Consolidations and Mergers

W. G. Rathke, of Eau Claire, was prevented from being present by illness, but his paper on consolidations and mergers was read by E. B. Bushnell, secretary of the association, and follows in part:

"A great deal of publicity as to the profits made in this business, together with the aggressive advertising and salesmanship of the machine companies, has led many people to invest their money in the concrete products business. Were there actual new business enough to warrant this new capital being put into plants there would be no complaint, but the fact is apparent to most of us that there is an overproduction in plants manufacturing concrete products in most localities.

Over-planting Leads to Abuses

"The excess of products plants has led to price cutting and other abuses of good business practice. When we overproduce on any commodity we tend to lower the prices at which we sell, regardless of the cost of production. This condition cannot go on indefinitely, and gradually plants will be eliminated and the surviving plants will reap a harvest, providing they too have not impaired their capital while this elimination process is taking place. The idea is, if possible, to work out a more equitable solution to this problem. Everyone who invested money in the products business did so in good faith and should be entitled to a fair return on his money.

"We have read a great deal during the past year of the consolidation of various lines of business. Can we not borrow from the experience of others and work out some such plan in our business? Of course, it would not be feasible to organize a whole state, but the state is made up of districts toward which business naturally gravitates, and these districts and cities can very easily consolidate their experience and assets for mutual profit.

"When we stop and think of the money that can be saved we realize that it is a natural thing to do. Sales and advertising expense would be saved. In fact, overhead items would all be reduced by more than one-half. Delivery expense would be saved, as orders could be delivered from the closest plant. Plants not now operating profitably due to location or design could be eliminated. We would save labor on the production end. All of us now are carrying labor through the slack season in order to keep experienced men. In consolidating, both sales and production would be under one management and a crew of much smaller size working on a twelve months schedule and properly handled on a piecework basis would undoubtedly produce enough units to supply the demand. A fair price could then be obtained for our products and uniform quality could be maintained. One large company manufacturing a good uniform product and passing required tests could exert enough influence with architects and contractors not now favorable to concrete products so that our goods would be specified on more and larger work.

Curing Concrete Products

L. E. Grube, president of the association, gave a paper on "Curing Concrete Products After the Steam Cure." He described how his company had installed a ventilating fan in its curing rooms which circulated the air in the rooms, the idea being that when the heat was raised to 75 deg. the air circulation would have the effect of a summer wind. This system was to be used after steam curing was completed, in order that the units might be delivered to the job quickly and yet not be moist. The first installation was not efficient, and a unit heater was added. This consisted of a number of horizontal copper tubes, resembling an automobile radiator, with a helical brass fan around each tube. The fan was mounted on the same chassis behind the unit heater and a low inlet provided air from outside the curing room so that a fresh supply was always being forced into the room. The outfit was mounted on casters so that it could be moved from one room to another. At the far end of the curing room an outlet was made and an exhaust fan installed which took the air out and sent it back to the shop outside. The arrangement worked satisfactorily and the units delivered to job or storage quite dry.

Discussion

In the discussion that followed, A. W. Scheer asked if this system of drying would produce as strong units as by ordinary drying methods. Mr. Grube said that it would produce stronger units, since his company could get more brick out of one sack of cement than they could formerly and still maintain the same strength. He believed this to be contrary to accepted theory. C. Weipking, head of the concrete testing laboratory of the Street Department of Milwaukee, said this was not contrary to theory, since the block had actually been steam-cured for 24 hours before drying, and it was proven that 24 hours steam curing was about equal to 28 days ordinary curing. Mr. Scheer asked if it was advisable to pile these blocks immediately in the storage yard, saying that his company was looking for some means of getting the block out of the curing room as soon as possible without having the danger of having them freeze solidly together in winter in the yard due to the contained moisture. Mr. Grube said that they could be put outside immediately, but must be covered to keep out rain or snow, which would have just as bad results as contained moisture.

Merchandising Cement Products

William Smythe, of the Portland Cement Association, Chicago, delivered a paper on "Concrete Products." He said that the concrete products industry must look to its merchandising as have its competitors, the lumber, clay-tile, and brick industries. He pointed to the national advertising campaigns of these industries as an example of what the cement products business will have to do. Mr. Smythe said that the products industry was comparatively young, and only recently had it outgrown its "back-yard" state. Now, however, the pendulum had

swung to the other extreme and too much machinery is being used. He pointed out that a machine or a plant should not remain idle 40% to 60% of the time, and said that the time is coming when the same equipment will be used for two or three shifts to meet the peak demand. He said that mergers should be given consideration as a means of decreasing the overhead and controlling sales methods, advertising and production methods.

In speaking of production methods, he said that economy required large size aggregate, but this should not be used at a sacrifice of strength. Also speeding-up of building made some manufacturers deliver wet units to a job, which later cracked. Furthermore, he warned against drying out units before they had been completely cured, and against improper tamping. He said that the Portland Cement Association was carrying on a campaign against such bad practices which would certainly aid the manufacturer. The Portland Cement Association is also aiding in selling the products by training salesmen. Later a book on selling is to be gotten out, and also a series of articles and plans for small homes will be brought out. When these articles by the association are used in conjunction with local advertising by the manufacturer, much can be accomplished. He urged that the supervision and specifications of the Underwriters Laboratories be used by the manufacturers, saying that they would furnish a good selling point as well as bring about better production methods.

Business Session

At the business session of the convention L. E. Grube was re-elected president, A. W. Scheer continued as vice-president, and E. B. Bushnell, of the Portland Cement Association, was re-elected secretary-treasurer. C. O. Gochnauer, Appleton; George Luetz, Beloit; W. G. Rathke, Eau Claire; T. Johnson, Ellsworth; A. W. Devos, Milwaukee, and J. Sorenson, Racine, were re-elected representatives for their respective districts. Mr. Grube was also elected to the position of director for the national association.

Cost Finding Methods

E. E. Sheasgreen, in his second talk before the convention, built up a specimen cost budget for a representative products plant. He called attention to the absolute necessity for maintaining such a system of cost finding, and stated that the questionnaires that had been returned to him indicated that many plants made no effort to keep such records, and that other plants attempted to keep records but did not understand many of the principles which should govern such records. For this reason it was necessary to begin at the very bottom and work out the whole system. The figures for production, costs and other items listed below are those given from the floor of the convention by the members themselves.

It was first decided to study a plant which would contain two power machines and would employ about eight men. The daily capacity would be about 3000 blocks, and on a basis of 300 working days this would be a yearly capacity of 900,000 block. It was assumed, however, that the output would be approximately two-thirds of the capacity, or 600,000 block. The plant was assumed to own its site and buildings, but not to own its gravel pit. The outline runs as follows:

I. INVESTMENT	
Plant and site	$20,000
Machinery	20,000
Cash on hand	2,500
Accounts receivable	10,000
Raw material on hand	1,000
Value blocks in process	8,000
	$61,500
II. ADMINISTRATION	
Executives salary	$ 5,000
Bookkeeper	2,000
Phone and telegraph	125
Office supplies	12
Office letterheads	100
Towels and ice	10
Postage	50
Taxes	1,000
Organization dues	100
Convention expense	100
Donations	100
Entertainment	50
	$ 8,647
III. PRODUCTION	
Payroll	$14,000
Cement	20,000
Sand	12,000
Water	100
Power	1,000
Fuel	900
Oil, small tools, etc.	500
Repairs	1,500
Fire insurance	100
Compensation insurance	500
Interest on investment	2,700
Breakage	1,000
	$54,300
IV. DISTRIBUTION	
Advertising, printing	$ 800
Advertising, salesmen	4,000
Good will allowances	2,500
Bad debts	500
Collections and attorneys	500
	$ 8,300
V. SERVICE	
(It was decided to assume the figures obtained to represent yard prices and hence no item for delivery is included.)	
SUMMARY	
II. Administration	$ 8,647
III. Production	54,300
IV. Distribution	8,300
V. Service	.....
VI. Replacement	1,290
Cost of operation	$72,537

This brings the yard price to approximately $0.122 per block (8x8x16 in.), with a production cost of about 9 cents and an overhead expense of 3.2 cents.

Comparing the above with actual records from three plants, we have: (A) Minneapolis plant, 200,000 capacity and 163,000 output; 19.6 cents total cost and 14.8 cents production cost, less 2.8 cents for included cost of delivery. (B) Minneapolis plant, 260,000 capacity and 102,000 output; 22.8 cents total cost and 14.6 cents cost of production, less 2.2 cents included cost of delivery. (C) St. Paul plant, 750,000 capacity and 450,000 output; 17.6 cents total cost and 12.7 cents cost of production, less 2.2 cents included cost of delivery. It is probable that some of the items in the assumed cost budget were not chosen high enough, though on the whole the figures should be fairly representative. The illustration serves chiefly to show how the cost system should be set up and what main features must not be omitted. If omitted, the system will show false results, indicating usually an unfounded prosperity.

In the discussion which followed Mr. Sheasgreen's talk, C. O. Gochnauer, of the Gochnauer Concrete Products Co., Appleton, declared that what was really necessary was a system which would show the expense of each operation, since the bank balance at the end of the year would show the profit or loss of the plant as a whole. Mr. Sheasgreen agreed with him but said that the questionnaire indicated that the fundamentals were required by the majority of the plants. He added that the division of costs between the various operations was the second step in the cost-keeping work.

Plant Design

Jack Franklin, of the Consolidated Concrete Machinery Corp., Milwaukee, gave a very good talk on "Plant Equipment." In speaking of financing a plant, he pointed out that a man must not only have the ability to get capital for machinery, but he must also be able to get enough to keep the plant running for some time before the profits come in. In picking a site he must decide on a territory which can take care of his proposed output, and, secondly, he must consider a site where there is room for expansion. Good transportation is also a deciding factor. In designing the proposed plant, the object is to get the most out of the given location. The "straight line" plant is the best, where there is no doubling back of the product, as it goes from the raw material to the finished product. The overhead system is the logical working out of this system, where elevators take the materials to raised bins from which they flow by gravity to the mixers and thence to the machines. This does away with elevators for wet material, which are hard to clean and wear out easily. Mr. Franklin recommended the use of dollies in kilns instead of transfer cars, as being more flexible.

Advertising

Bert Wheeler, advertising manager of the Marquette Cement Manufacturing Co., completed the program with a talk on "Planned Advertising." He said that all that was necessary for successful advertising was the application of common sense to salesmanship. The first step is to chart a course to follow, and get a budget. The market must be analyzed to determine what kind of advertising is best. Mr. Wheeler emphasized the need of in-

fluencing the home buyer, the architect, the contractor and the dealer. He suggested the need of standardizing on something, such as a characteristic trademark, color, type size, or slogan. The direct mail advertising is a follow-up of the outdoor advertising. He particularly pointed out that the concrete products business has so grown that it is no longer possible for a manufacturer to rely on the advertising of his association or of the cement companies. Those means, he said, are all right, but each company must follow up with its own personal advertising.

On February 2 the convention banquet was held at the Hotel Schroeder, with L. S. Brodd, district engineer of the Portland Cement Association, as toastmaster. The entertainment at the banquet was certainly "hot," for which the association can thank the various manufacturing companies who furnished it.

Permanent Concrete Products Co. Building Plant in Columbus

THE Permanent Concrete Products Co. of Greenville, Ohio, is constructing a new plant in Columbus which is expected to be in operation in April. It is understood that the general offices of the company are to be moved to the Columbus location from Greenville, where they are at present. The new plant will be the third unit of the company, a branch plant being in operation at Kalamazoo, Mich., as well as the original plant at Greenville. Two more branch plants are contemplated at Chicago and Detroit in the near future. The Columbus plant is located at Barthman avenue and the New York Central tracks, and the company has acquired an additional five acres of adjacent land for future expansion. Among the products to be manufactured are concrete slabs for grade crossings, fence posts, mile posts, property line posts, elevation posts, crossing sign posts, pipe carrier foundations, rail rests, cribbing units and other related railroad products. George E. Nagel is general manager of the new plant.—*Columbus* (Ohio) *Dispatch.*

Tariff on Foreign Cement Is Urged

CITING a loss to American industry of over $19,000,000 through the importation of foreign cement and demanding a tariff levy to check the increase of European and Canadian shipments to the United States, John H. Camlin, president of the Illinois Chamber of Commerce, recently urged all members of the Illinois delegation in Congress to support such a measure.

"The increasing seriousness of the situation demands immediate action and the next Congress, apprised of the existing crisis, cannot overlook the dire need for a tariff levy to protect a major American manufacturing industry against the threat of cheap, foreign labor," Mr. Camlin declared in a letter to the Illinois senators and house members.

Asserting that the cement industry is one of the few major industries of the United States not given tariff protection, Mr. Camlin asked that it be provided with a barrier against the imported product, made "under wage scales and working conditions unthinkable for American laborers." He declared that aided by low water shiping rates, European and Canadian cement produced by cheaply paid workmen could be shipped across the Atlantic, barged up the Mississippi and sold in the natural market of the Illinois and middle-western cement manufacturers at a price below the cost of production of the domestic product.

At the same time that Mr. Camlin was working in Illinois there have been developments in other parts of the country toward placing a tariff on imported cement. Congressman White of Maine recently declared that he was convinced that the tariff was necessary and that he would support any move toward it. At the other side of the country, veterans' organizations of Portland, Ore., were applying pressure on the Veterans Bureau in Washington, D. C., to induce the use of Pacific coast materials as far as possible in the construction of the new veterans' hospital in Portland, and chief among the contracts, according to the statements of the organizations, was one for 23,000 bbl. of cement which the government intended to give to foreign interests. In Texas, E. S. Morgan, vice-president of the Texas Portland Cement Co., Dallas, Texas, was asked to appear in Washington before government officials to represent the Texas mills in their effort to have the tariff placed on cement imports. The reason for the necessity of such a duty was apparent, it was pointed out, from a recent press dispatch which stated that the skilled workers in the Belgian cement plants were demanding a *raise* to $428 a year, in order that they might be able to support their families. It is not compatible with the American standard of living to produce a commodity which would compete with such wages, declare the supporters of the proposed tariff.

While this controversy was being carried on all over the United States, it was recently announced that another large cargo of Belgian cement had arrived in this country on the *S. S. Euphorbia* of England. The cargo is made up of nearly 1500 tons of cement, which is the largest single importation of cement into this country in the last six months, and the largest shipment ever to reach Houston, where the ship docked.

National Concrete Products Convention to Meet in Philadelphia

THE annual convention of the Concrete Products Association will be held at the Benjamin Franklin Hotel in Philadeplhia on February 27 and 28. This meeting will be held in conjunction with the annual convention of the American Concrete Institute, which is to meet in Philadelphia on February 28 and 29 and March 1. It is expected that cement products manufacturers from all over the United States will be in attendance.

Two Ohio Cinder Block Companies Merge

MERGER of the Springfield Cinder Block Co. of Springfield, Ohio, and the Dayton Brick Co. of Dayton, was recently announced by C. I. Weaver, a director of the Springfield company. The necessity for increased plant facilities to fill the demand for cinder blocks was given by Mr. Weaver as the reason for the merger.

The Springfield Cinder Block Co. was incorporated in 1925 with John L. Bushnell as president, William McElroy, secretary, and L. E. Brown, treasurer.

The Dayton Brick Co., which distributes sand, gravel and concrete building materials, was incorporated in 1922. Oscar Kressler is president, treasurer and general manager. He was for many years identified with the National Cash Register Co. and the General Motors Corp., Delco Ignition Division.

R. P. Brown Introducing New Cement Wall-Finish

A NEW decorative wall-finish has recently been placed on the market by the Zonta Corp. of Washington, D. C. R. P. Brown, formerly with the National Lime Association, Washington, is general manager of the new concern and has done considerable in introducing the product already. "Zonta" is a plastic wall-covering having a white portland cement base. It is claimed that it is permanent and moisture proof, and actually improves in appearance and quality with time. The new product can be applied in any of the usual textures, either by plasterers or by painters.

Large Australian Cement Works to Move from Tasmania to Mainland

ONE of the largest Australian cement undertakings, the National Portland Cement Co., has decided to transfer its manufacturing plant from Maria Island, off the coast of Tasmania, to a location in Victoria on the mainland. Such a transfer was declared by the directors at the recent annual meeting to be advisable owing to the increased competition in interstate trade, the comparatively limited market available in Tasmania and the preference of local authorities for cement made within their own states. Much loss and inconvenience has also been occasioned by the fact that the enterprise is at present dependent upon coastal freighting. Options have been taken upon a large limestone area at Port Fairy, Victoria, and the works will probably be moved to the location.

Passage of Particles Through Rotary Cyclindrical Kilns*

By J. D. Sullivan, C. G. Maier and O. C. Ralston

IN the course of its efforts to increase efficiency in the mineral industries the Bureau of Mines is investigating the basic principles involved in the construction and operation of devices for the treatment of ores and minerals. This paper presents the results of a study of the flow of material through rotary kilns of the type used in the manufacture of portland cement clinker.

The object of this study was to determine the factors that influence the rate of progress of crushed materials through a kiln. There is distinct need for such data in the design and construction of kilns for drying, roasting, calcining, nodulizing or otherwise treating crushed solid materials. Hitherto the practice in the design of such kilns has been largely to copy from kilns already in use the dimensions that give the properties most nearly satisfactory. The writers wished to develop a "kiln formula" that would fit all the conditions studied and remove guesswork from the design of rotary kilns.

As a result of this study it was possible to assemble all the facts noted into a single equation which expresses the time of passage of solid materials through a rotating cylindrical kiln of any of the sizes usually desired, when the kiln is operating under conditions that approximate those of actual practice. This kiln formula is entirely empirical but usually predicts within 2 or 3% and is seldom more than 6% in error. It is as follows:

$$t = \frac{1.77 l \sqrt{\theta}}{pdn} \times \text{factor}$$

where t = time of stay of the material in the kiln in minutes.
l = length of the kiln in feet.
p = slope or pitch of the kiln in degrees.
d = diameter of the kiln in feet.
n = revolutions per minute.
θ = angle of repose, in degrees, of material in the dry condition.

Other symbols which will be used in succeeding formulas are as follows:

v_f = volume of feed per hour.
v = volume of the kiln; v_f and v are to be expressed in the same units; for example, in cubic centimeters or cubic feet.
h = height of the constriction $[= \frac{1}{2}(d^\circ - d')]$.
d' = diameter of constriction opening.
d° = diameter of the kiln; h, d' and d° must be expressed in the same units. $d^\circ = d$, when d° is expressed in feet.

*Abstract of Technical Paper No. 384, U. S. Bureau of Mines.

The "factor" is a correction for nose rings or constrictions. The value of the factor is 1 for simple unobstructed rotary cylindrical kilns.

The formulas for four different kiln conditions follow:

1. The formula for a simple kiln with no obstructions or constrictions may be expressed by the following formula:

$$t = \frac{1.77 l \sqrt{\theta}}{pdn}.$$

2. For the condition where the uniform depth of bed of material in the kiln is less than the height of the constriction the following formula has been presented:

$$t = \frac{1.77 l \sqrt{\theta}}{pdn} \times e^{\left[(0.12 l/d - 3.86) \log \frac{2.5 v_f}{n v^\circ} + e^{2.3 - 0.32 l/d} - 1\right] \frac{h}{d^\circ - 2h}}$$

3. When the uniform depth of bed of material is greater than the height of the constriction and the constriction is at the discharge end of the kiln, the equation is

$$t = \frac{1.77 l \sqrt{\theta}}{pdn} \times \frac{1}{(0.34 - 0.64 d^\circ/d') \frac{2.5 v_f}{n v^\circ} + 1.16}$$

4. When the uniform depth of bed of material is greater than the height of the constriction and the latter is at a position other than the discharge end of the kiln, the following is the equation:

$$t = \frac{1.77 l \sqrt{\theta}}{pdn} \times \frac{d^\circ/d' - (0.8 - 0.3 l/d)}{0.3 l/d + 0.195}$$

Equation 3 holds when the ratio of diameter of the kiln to the length of the kiln is 1:14. For other ratios methods of calculation have been given. The formulas are for constrictions of narrow width. The correction factors, as determined in the laboratory kiln, are probably accurate to better than 5%.

The mathematical principles developed in this report should find useful application in the design of all types of rotary-kiln furnaces, cylindrical driers and cylindrical feeders, not only in the mining and mineral industries but in other industries employing similar machinery.

Experimental Kilns Used

The general principles and the mathematical formula were developed by study of a small laboratory kiln built on such a scale that a 1-in. dimension represented roughly about 1 ft. of a full-size kiln. Later the kiln formula developed as a result of this research was checked against a variety of operating kilns. The experimental kiln was electrically driven through a friction disk with which the rate of revolution could be varied at will. The slope could be changed by means of a worm-gear jack under one end. The kiln was 7 ft. long, and a series of shells 3, 6, 11½ and 19¾ in. in diameter was used in alternation for the study of diameter effects. A 5-ft. kiln, 3¾ in. in diameter and electrically heated, was also used. This equipment in all amounted to five separate kilns, 3, 3¾, 6, 11½ and 19¾ in. in diameter. The interior of the shells was made rough by sizing it with glue or varnish and coating it with sand. The discharge end was open, but at the feed end was a diaphragm having an opening just large enough for the feed pipe from a mechanical feeder to be slipped through readily. This feeding device was capable of delivering varying amounts of feed.

This investigation of the passage of solid particles through rotary kilns was conducted under what might be termed "ideal conditions." No chemical change occurred, and the angle of repose remained constant during the passage of the material through the kiln. Although this is true, the simple straight-kiln formula has been found to work very well in all commercial kilns that were available for study. The authors visited a number of cement kilns and two coal driers and took measurements. The calculated time of passage in one cement kiln 125 ft. long was 73 min.; from observations made during the manufacture of oil-well cement, where certain ingredients were added at a definite time and analyses were made of the clinker at given intervals, it was found that the time of passage actually ranged from 60 to 70 min. For a clinker cooler 60 ft. long the calculated time of passage was 26 min. and the observed time 25 min. For a single-shell externally heated coal drier the calculated time of passage was 21.4 min. The kiln was not running when seen, but figures available at the plant showed that the time of passage was a little less than 25 min.

For a Ruggles-Coles drier, with an external shell 7½-ft. in diameter and a space of 1½-ft. between the inner and outer shell, the time observed was about 38 min. Calculating this on the basis of a simple 7½-ft. kiln gives the time of passage as 12½ min. However, by calculating as a 1½-ft. kiln, the difference between the shells, the calculated time was 39 min. No more kilns of this type were available for checking this observation; so it is mentioned for what it is worth.

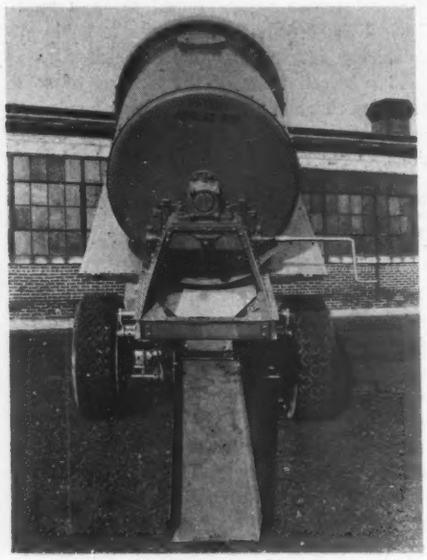
Empirical formulas have been presented which enable one to calculate the time of passage of solid particles through rotary cylindrical kilns. Correction factors for nose rings or constrictions have been added.

In the simple kiln equation there are six variables; if any five are known, the other can be determined.

New Machinery and Equipment

New Truck Conveyor for Ready-Mixed Concrete

A NEW CONVEYING TRUCK for hauling ready-mixed concrete from central mixing plants to different jobs is announced by the Clinton Motors Corp., Reading, Penn. Efficient and economical delivery of concrete are claimed for the



Rear end of new truck conveyor for ready-mixed concrete showing the dumping arrangement

new conveyor, and the concrete when poured from the body is said to show no signs of segregation even after a haul of 30 miles covering a period of three hours.

The conveyor consists of a steel cylinder mounted on a truck chassis. This cylinder is rotated by a separate power unit after the mixed concrete is placed within and the inlet and outlet hermetically sealed. No difficulties are said to be experienced in unloading the mixed concrete at the job. The accompanying views show the conveyor truck in position ready for loading and the cylinder raised to discharge its contents.

The entire unit, including the truck, is manufactured by the Clinton Motors Corp.

New Industrial Tractor

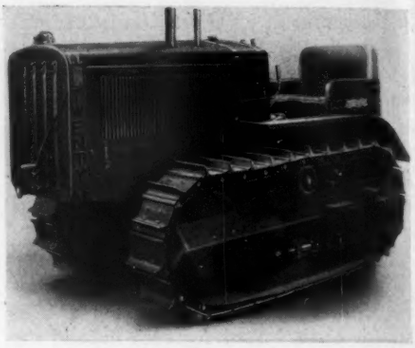
THE CATERPILLAR TRACTOR CO., San Leandro, Calif., and Peoria, Ill., announces a new model tractor designated as the "Caterpillar" Twenty. The new model takes its name from the fact that its rating is 20-hp. at the drawbar.

The "Twenty" is a new tractor in size, rating and price, built to fit into a line of bigger machines, the "Thirty" and the "Sixty," as well as the smaller "2-ton," and to supplement these models in general industrial work, according to the company.

The new model is equipped with a gasoline engine which has a rated speed of 1100 r.p.m., 20 drawbar horsepower and 25 belt horsepower. The transmission is of the selective gear type, three speeds forward and one reverse. Low speed is 1.79 m.p.h. and high, 4.67 m.p.h.

Overall dimensions of the new tractor are: Length, 115.5 in.; width, 61 in.; height, 60.5 in. The ground clearance under transmission is 12 in. Approximate net weight of the machine is about 7000 lb.

Special equipment can be furnished to meet a variety of requirements of the owner, the manufacturers say. This equipment includes such items as special track shoes in place of the standard 11 in., an electric starter with



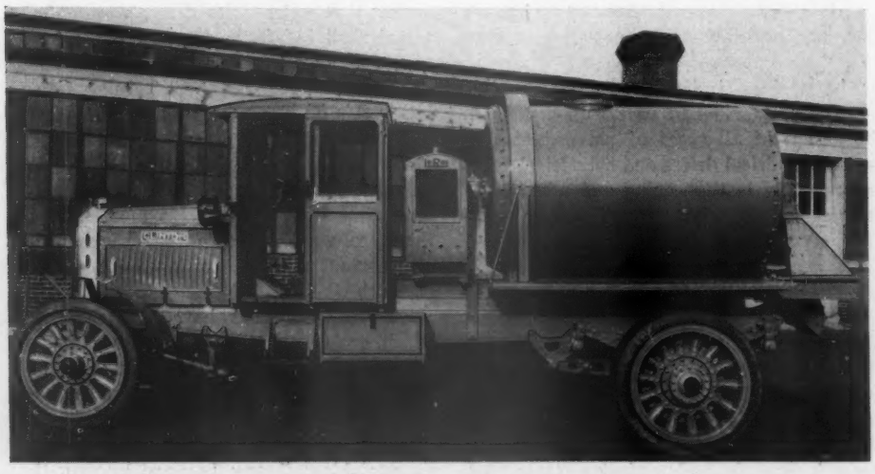
New 20-hp. industrial tractor

floor button, exhaust muffler, street plates without projecting grousers or bolt heads, odometer for registering mileage and a special carburetor for use with alcohol as a fuel.

New Attachments for Small Power Shovel

THE HARNISCHFEGER CORP., Milwaukee, Wis., has brought out two additional attachments for its recently introduced ½-yd. shovel, the so-called "Groundhog." The new hoe and skimmer booms are built of heavy I-beams, securely trussed and braced, all joints being electrically welded. The hoe has a rated digging depth of 16 ft. and the hoe dipper is shaped from boiler plate, the seams being electrically welded.

The skimmer bucket is also constructed from boiler plate and has heavy spring bumpers, cast integral with the boom foot, a feature through which heavy jolts on the boom are said to be eliminated.



Truck conveyor in loading position

Large Wheel Truck for Oxy-Acetylene Equipment

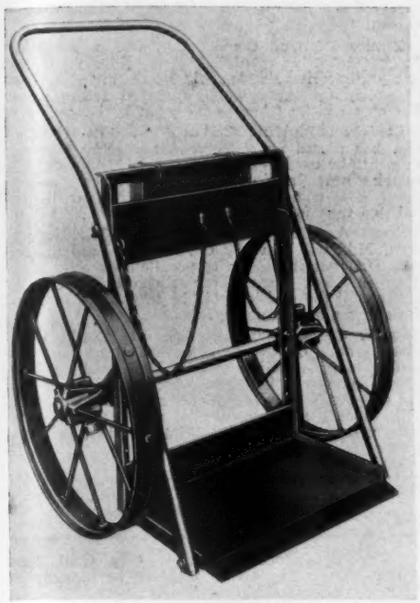
AFTER THOROUGH tests in field and shop, a new type of two-wheel truck has been put on the market by the Oxweld Acetylene Co., New York. Increase in wheel size was a primary consideration in the design, larger wheels making the truck much easier to handle.

The illustration shows the new truck equipped with 24-in. steel wheels, having 3x⅜-in. grooved tires and a cast iron hub. The hub is bored to fit the cold-rolled steel axle and a grease cup is provided. Lubrication is of particular importance in overland pipe line work where the truck may be hauled long distances at fairly high speed behind a motor truck.

Other improvements have been made. The

handle is continuous and the upper portion is bent back about 8 in. so that the truck can be easily handled by an operator of small stature. The tool box is larger and is provided with a cover and a hold for extra blowpipe tips.

Where 24-in. wheels are not required,



New wheel truck for oxy-acetylene equipment

14-in. wheels may be used instead merely by changing the position of the axle to the lower set of holes which are already drilled in the frame. The same frame and axle can be used with either size wheels. No grease cups are necessary with the smaller wheels.

New Four-Cylinder Industrial Gasoline Engine

WAUKESHA MOTOR CO., Waukesha, Wis., announces the latest addition to its line of industrial engines—a new four-cylinder unit which follows many of the features of other Waukesha engines. The bore and stroke are 6½x7, giving it a piston displacement of 929 cu. in. It is a companion to models JS 5½x7 and JL 6x7 engine, and is known as model JK.

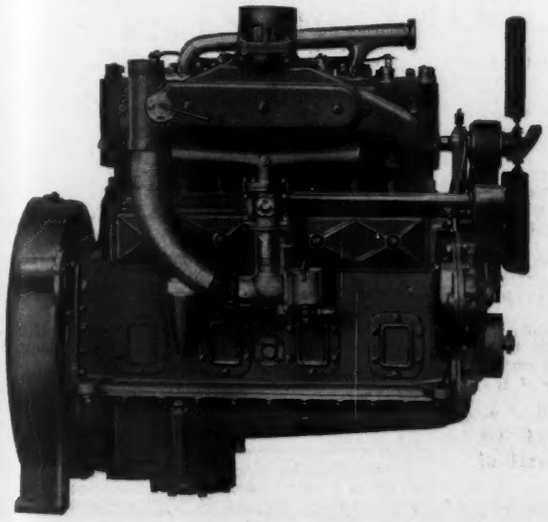
The new engine features a Ricardo combustion chamber, truncated cylinders cast in pairs, twin-cast demountable cylinder heads, deep cast iron crankcases with oversize center bearing, full pressure oiling and Waukesha built-in governor.

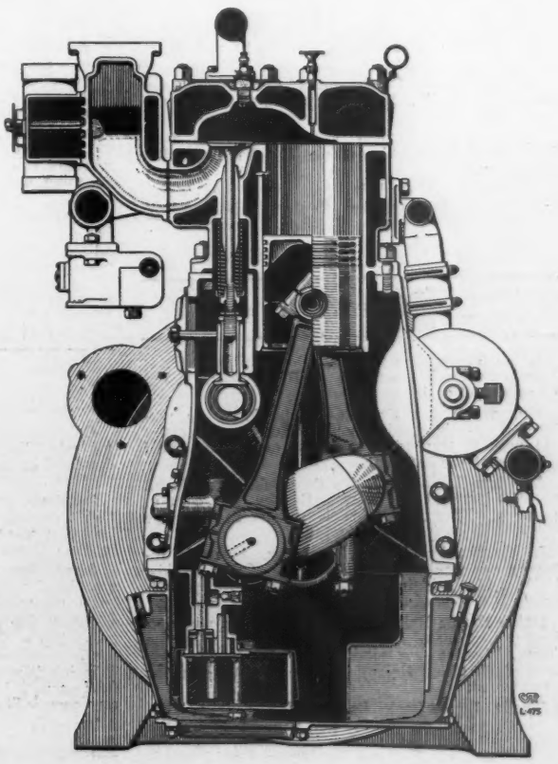
Other features are seen in the cross sectional view and include large four-bolt connecting rods with replaceable bronze backed babbitt bearings, large capacity oil and water pumps, large valves surrounded by a big volume of water, outside adjustment of oil pressure and readily removed oil screen.

The engine is available as a complete power unit including radiator, house, and all accessories for portable power for either belt, gear, coupled or chain drive, or independently for installation by manufacturers of power-driven equipment.

The new JK engine was displayed for the first time at the recent Cleveland Road Show.

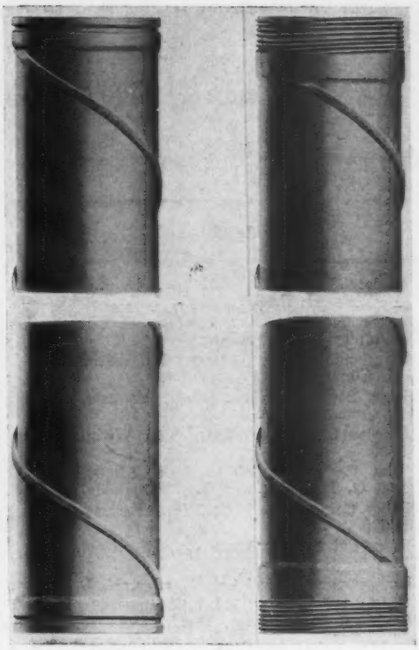
Below, left—New four-cylinder industrial gasoline engine and right—a section through the engine to show construction





New Spiral Welded Pipe of Wrought Iron

A NEW TYPE of welded pipe, combining the features of Naylor spiral "Lock-Seam" pipe and Toncan iron is announced by the Naylor Spiral Pipe Co., Chicago, Ill. The new pipe is called "Spiralweld" iron pipe and is made in wrought pipe standards, size 4-in. to 12-in., and in 20-ft. lengths, threaded ends for standard screw fittings and flanged ends for standard flanged fittings,



Spiral welded pipe in wrought iron. Left—standard flanged fittings and right—standard screw fittings

black, galvanized or asphalt-dipped.

The new pipe is offered by the manufacturers for uses where resistance to high pressures is required, its comparative lightness being a desirable feature. Its smooth interior is claimed to cut down frictional resistance to a minimum and the Toncan iron construction makes it suitable for conveying materials conducive to rusting and corrosion, according to the manufacturers.

News of All the Industry

Incorporations

Pioneer Gravel Co., Helena, Mont., $50,000. T. B. Weir, H. P. Bennett and J. T. Mitchke.

Joseph Hendler Stone Quarry and Construction Co., Adhley Borough, Penn., $10,000.

Maryland Lime and Cement Co., Baltimore, Md. C. H. Classen and J. S. Hunter.

Pope Sand and Gravel Co., Yonkers, N. Y., 1,000 shares common stock.

Peoples Sand and Supply Co., Wichita, Kan., $10,000.

Flint Rock Co., Odessa, Tex., $50,000. J. T. Nikon, O. L. Rifner and B. A. Reynolds.

Faber Cement Block Co., Inc., Paramus, N. J., $125,000.

Riverhead Cement Block Co., Riverhead, N. Y., $25,000.

Northwestern Gravel Co., Mandan, N. D., 10,000 shares no par value.

American Silica Corp., Dover, Del., 100 shares common stock.

Battle Creek Duntile Co., Battle Creek, Mich., $50,000 preferred stock and 5,000 shares of common stock at $10 each.

Southern Asbestos and Magnesia Corp., Los Angeles, Calif., $100,000. Stanley L. Plant, James A. Flannagan and Clyde E. Grafton.

Swendsen-Richards, Inc., Seattle, Wash., $2,000. To deal in sand and gravel, etc. W. C. Richards and Ofell H. Johnson.

Concrete Materials Co., Waterloo, Iowa, $10,000. H. D. Ballamy, of Eddyville, Iowa, and T. E. Rust of Waterloo.

National Cement Pipe Co., Los Angeles, Calif., $50,000. D. J. Milosevich, A. R. Milosevich, S. A. Chuk, D. M. Thomas and Leslie Cranbourne.

City Tile Co., Winston-Salem, N. C., $125,000. Henry Wolfe, Mt. Airy; George H. Cox and H. C. Perkins, Winston-Salem.

Salem Quarries, Inc., Winston-Salem, N. C., $125,000. George H. Cox and H. C. Perkins, of Winston-Salem.

Marianna Lime Products Co., Marianna, Fla., has increased its capital stock from $1,000,000 to 60,000 shares of no par value stock.

Enos Sand and Gravel Co., Fort Worth, Tex., $100,000. W. P. Morris, W. S. Willis and D. L. Morris.

Ironton Gravel Co., Ironton, Ohio, 500 shares no par value. M. M. McKain, Harry Nicely and G. C. Ross.

Camp Logan Cement Works, Houston, Tex., $1,000. Louis Michka, Elsie Michka and Lillie Singletary.

United Rock Asphalt Co., Nashville, Tenn., $200,000. C. H. Anderson, Benton McMillin, J. F. Ashley, Z. E. Robinson, W. T. Lasley and A. H. Roberts.

Quarries

J. H. Giroux & Co., Ltd., Deschambault, Que., Canada, recently installed a Bucyrus-Erie 31-B steam shovel at its quarry.

Pilot Knob Ore Co., St. Louis, Mo., has produced a very interesting pamphlet on the properties and uses of trap rock, which is one of the chief products of the company.

American Lime and Stone Co., Bellefonte, Penn., recently installed 15 Easton Granby-type cars in its mine. The installation is unique in that the operation is entirely underground.

L. G. Everist, Inc., Sioux City, Iowa, is installing new equipment at its quarry at Dell Rapids, S. D., which will increase the capacity to approximately 500 tons of crushed granite daily.

Union Pacific Railroad is reported to be planning the development of a limestone quarry near Granite Canon, Wyo., a few miles west of Cheyenne. Two hundred thousand dollars will be expended in the development.

Ainslie Lime Rock Co., Bleckly county, Ga., has been placed in involuntary bankruptcy by the petition of S. S. Chandler of Macon, Ga., the Taylor Furniture Co., and the McRae-Daniel Hardware Co., of Bleekly county, who are the creditors. Mr. Chandler has been named as receiver. The company has ceased operations.

Brookfield, Ill. The representatives of quarries located near Brookfield, a suburb of Chicago, have agreed to abate as much as possible the annoyances caused by the jar and vibration of blasting. The companies represented at a recent meeting held to discuss the matter were the Consumers Co., Dolese & Shepard Co., Peoples Crushed Stone Co., Superior Stone Co., Federal Stone Co. and Riverside Lime and Stone Co.

Sand and Gravel

Wolf Creek Sand and Gravel Co., St. Louis, Mo., has begun operating its new plant at Delight, Ark., producing about 15 cars daily.

Koenig Coal and Supply Co., Oxford, Mich., has recently placed a Bucyrus-Erie 50-B shovel in operation at its pit east of Oxford.

Little Piney Sand and Gravel Co., Newburg, Mo., is reported to be making improvements at its pit at Orvis Switch, Mo.

McGrath Sand and Gravel Co., Chillicothe, Ill., is installing a pontoon and some new machinery at its pit, the total cost to be several thousand dollars.

Northwestern Gravel Co., Des Moines, Iowa, is contemplating the removal of its offices to Lake View, Iowa, where they will be housed in one of the company's buildings at its plant there.

Superior Sand and Gravel Co., Seattle, Wash., has sold the lease on its pit and plant at Friday Harbor, Wash., to Phillip Morrison, Seattle, and Wm. Gaul, Tacoma, who will operate the pit in the future.

Washington County Brick and Gravel Co., Hanover, Kan., is preparing to open a gravel pit on the Little Blue river near Hanover. The Washington County company is a new concern, operated by John Westover, a Lincoln, Neb., contractor.

Alabama Sand and Gravel Co., Montgomery, Ala., has opened a sales office for the Birmingham district at 208 Martin Bldg., Birmingham, Ala., and J. D. Wilson, who has been connected with the company for more than four years, will be the representative there.

Standard Sand and Gravel Co., Lillington, N. C., is reported to be contemplating the construction of a new gravel washing plant to replace the company's old plant, which has been idle for more than a year. It is understood that the company owns 800 acres of good gravel land near Lillington.

Victory Sand and Gravel Co., Topeka, Kan., recently let a contract for its new office building at Harrison St. and the Kansas river, Topeka. A contract was also let for a boat to carry the modern pumping unit to be used in getting sand from the river.

Roquemore Gravel Co., Montgomery, Ala., has bought 100 acres of land near Flomaton, Ala., and adjacent to 150 acres of undeveloped land previously owned by the company. The purchase was made from the Escambia Sand and Gravel Co. It is reported that it is planned to develop the property shortly.

Cement

Carney Co., Mankato, Minn., has let the contract for rebuilding the portion of its mill which was damaged by fire last November. The work will cost $125,000.

Southwestern Portland Cement Co., Los Angeles, Calif., recently received a contract to furnish 50,000 bbl. of cement from its El Paso plant for paving in Tom Green county, Texas.

Giant Portland Cement Co., Philadelphia, has completed a two-story concrete building, to be used as a community welfare center, at its works at Egypt, Penn.

Louisville Cement Co., Louisville, Ky., has recently published a booklet on "The Fair Price Principle" containing a concise statement of the fundamental business principle of a fair price for any commodity.

Petoskey Portland Cement Co., Petoskey, Mich. Application has been made by the Grand Rapids and Indiana R. R. to the I. C. C. for authority to construct a 2-mile line to serve the Petoskey Cement Co.

Trinity Portland Cement Co., Dallas, Tex., has purchased 165 acres of land near Houston on the San Jacinto river, which will be developed to produce clay for the company's new Houston plant. The clay will be taken to the plant by barges.

Louisiana Portland Cement Co., New Orleans, La., has placed an order for three more 1400-ton barges to be used in carrying raw material from the quarries near Jackson, Ala., to the New Orleans plant. The company is now operating six barges and two tugs for this work.

North American Portland Cement Co., Hagerstown, Md., will move its Cal Division headquarters from Hagerstown to the corporation's general sales office in New York City. Richard H. Catlett, manager of the division, will be transferred to New York in the same capacity.

Pacific Coast Cement Co., Seattle, Wash., is to start at once on the first portion of its northern work—the construction of a $60,000 dock at Dall Island, Alaska. The dock, which will extend out into the water 200 ft., will be constructed on crib work, since the bottom at that point is hard rock. Construction work on the Seattle plant will be commenced within a few weeks.

Cement Products

Ramona Art Stone Co., Culver City, Calif., has let the contract for a new plant to be located on Venice Blvd. near National Blvd.

Duro Stone Laundry Trays, Portland, Ore., has let the contract for a 100x100-ft. factory to cost about $15,000.

Universal Magnesite Products Co., Escanaba, Mich., is planning to build a 30x30-ft. addition to its plant for curing cinder concrete units.

Duntile and Concrete Products Co., Crystal Lake, Ill., has employed W. F. Richards, architect, as sales manager.

Concrete Products Co., Birmingham, Ala., has changed its name to the Concrete Products and Roofing Co.

American Stone Mfg. Co., San Francisco, Calif., has begun the manufacture of synthetic marble building material at 166 Twelfth St., San Francisco, with C. A. Snapp as president.

Southern Building Block Co., Charleston, S. C., is reported to have leased a building which will be remodeled for a factory to manufacture cinder concrete building units under the "Straub" patents. M. A. Winchell and P. A. Winchell of New York City are the organizers of the new company.

Nebraska Concrete Products Association recently held its annual meeting in Omaha and elected the following officers: Frank Whipperman, Omaha, president; E. L. Bateman, Bethany, vice-president; Charles Patterson, Omaha, treasurer, and Roger Merritt, Lincoln, secretary.

All Locking Zinc Shingle Manufacturing Co., Owensville, Mo., is completing the installation of machinery at its new cement products plant at Jefferson City, Mo. The new plant will turn out H-shaped haydenite concrete brick as well as regular concrete brick. L. D. Brandt, of Owensville, will be the manager of the new plant, while E. F. Schaffer will have supervision over both the Owensville plant and the Jefferson City plant.

Lime

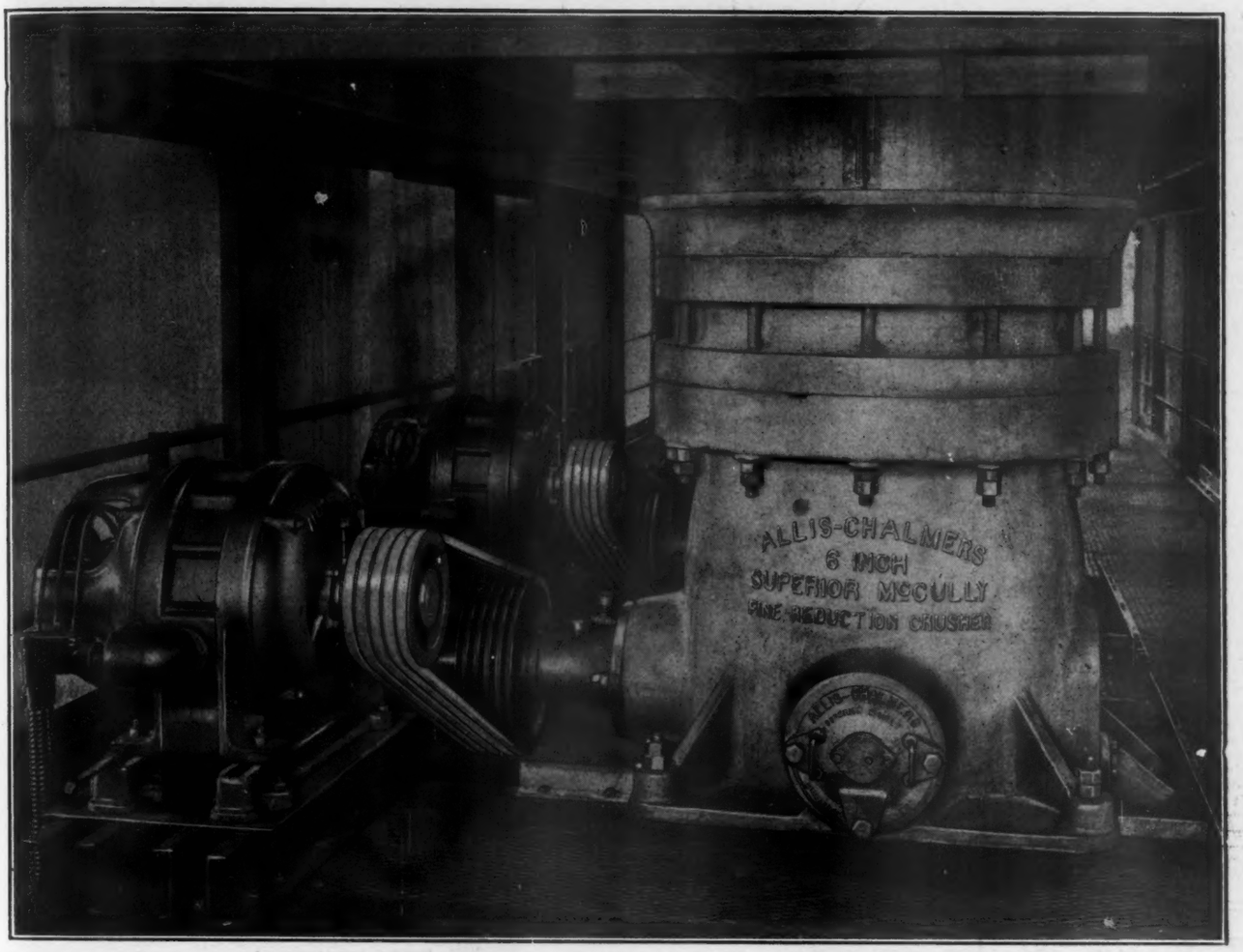
Calera Lime Works, Calera, Ala., is installing a Schultheiss hydrating plant, manufactured by the McGann Mfg. Co.

Cheney Lime Co., Allgood, Ala., has opened branch sales offices in Birmingham.

Rock Castle Cement and Lime Co., Pine Hill, Ky., has completed the instalation of a new hydrating unit.

Miscellaneous Rock Products

Virginia-Carolina Soapstone Co., Roanoke, Va., has denied a recent report that it was contemplating the construction of a $400,000 soapstone plant in Ashe county, N. C.



Allis-Chalmers 6" Superior McCully Fine Reduction Gyratory Crushers driven by Allis-Chalmers 50 HP. Type ARY Slip Ring Timken Roller Bearing Motors through Texrope Drives.

Capacity Strength Dependability

The Texrope Drive enables the motor to be placed close to the crusher and its flexibility protects the motor from shocks. The Allis-Chalmers roller bearing motors are dust proof and require only infrequent greasing. This combination insures continuity of service at lower maintenance cost.

MODERN business conditions demand high capacity, strength and continuity of operation together with simplicity. The Superior McCully Fine Reduction Gyratory Crusher has proved itself the world over for these requirements. It is readily accessible, has a short rigid hollow bored forged steel main shaft, large cast steel eccentric, cut steel gears, positive geared force feed oiling system and reversible top shell with vertical concaves. These features together with the inherent advantages of the Superior McCully Gyratory Crusher design result in the lowest operating costs.

ALLIS-CHALMERS
MILWAUKEE, WIS. U.S.A.

Asbestos Corp., Montreal, Canada, recently awarded the contract for approximately one million yards of stripping to Roger Miller & Sons of Toronto.

Ohio Valley Rock Asphalt Co., Louisville, Ky., has appointed J. B. Wilson sales manager. Mr. Wilson is well known as a consulting engineer, and was recently chief engineer of the Louisville Water Co. and also city engineer for a time.

Marine Products Corp., Seattle, Wash., is now installing machinery in its new factory in Seattle and expects to have the plant in operation shortly. This company, among other materials used in producing fertilizer, obtains rock phosphate from deposits in Idaho.

Kentucky Rock Asphalt Co., Kyrock, Ky., has transferred William Speed from his position as sales representative for the company in Florida to a similar position for the eastern portion of Kentucky. Mr. Speed has had experience both as a landscape architect and as a paving contractor in the territory which he will take care of.

Personals

Hal G. Knight, general manager of the Rubber City Sand and Gravel Co., Akron, Ohio, was elected president of the Akron City Club recently.

H. M. Davidson, who has been connected with the Hayward Co., New York City, for a number of years as general manager, is leaving that company. Mr. Davison's plans for the future will be announced at an early date.

Lacey A. Wagner, formerly a chemist for the International Cement Corp. at Norfolk, Va., has resigned from that position and has taken a position with Falkenberg & Co., Seattle, Wash., where he will be employed in testing cement on a number of large construction projects in the northwest.

Charles Boettcher, president of the Colorado Portland Cement Co., is now president of the San Luis Southern R. R. Mr. Boettcher, R. J. Morse, treasurer of the cement company, and George T. Kearns, vice-president of the cement company, bought the railroad to save it from being junked. It will be used in the development of the timber creosoting company which the cement executives recently organized. The price paid for the railroad was $53,000, although a government valuation was $300,000.

W. M. Weigel, mineral technologist of the Southern Pacific Raliroad Co., was a visitor at ROCK PRODUCTS' office recently. Mr. Weigel is well known to rock products producers throughout the country through his previous connection with the U. S. Bureau of Mines and many of his technologic papers on rock products published at various times in ROCK PRODUCTS. For a number of years he has also delivered interesting papers on the industry at the annual conventions of the two national aggregate associations.

Obituaries

Henry M. Young, owner of the Eaton Cement Tile and Coal Co., Eaton, Ohio, died on January 27 following a heart attack.

Harold F. Ireland, vice-president and superintendent of the Collins Concrete Pipe Co., of Portland, Ore., died on February 10, following a major operation. Mr. Collins was born in Cleveland, Ohio, 31 years ago and went to Portland in 1917, where he helped in the organization of the Collins company in 1922. He was well known in his work with the Northwest Concrete Products Association.

Manufacturers

Caterpillar Tractor Co., San Leandro, Calif., recently announced a number of substantial price reductions on its tractors, representing cuts of from 8% to 11% on the various models.

Kennedy-Van Saun Mfg. & Eng. Corp., New York City, announces the removal of its offices to the No. 2 Park Avenue Bldg., New York, on February 14.

Leeds, Tozzer & Co., Inc., New York City, has been appointed special sales representative for the Thew Shovel Co. of Lorain, Ohio, and the Universal Crane Co. of Elyria, Ohio, for the Eastern States.

Atlas Engineering Co., Milwaukee, Wis., recently sold its mortar and plaster mixer department to the Chain Belt Co., Milwaukee, and has changed its name to Zimmermann Engineering Co. It will continue to manufacture other mechanical specialties.

Morse Machine Co., Ithaca, N. Y., has recently appointed T. M. Manley manager of the district including the Mohawk Valley, Northern New York, Vermont, Western Massachusetts and Northeastern Pennsylvania. Mr. Manley, who has been with the Morse company for 20 years, will have his headquarters at Ithaca.

Easton Car and Construction Co., Easton, Penn., has recently completed the installation of ten semi-Phoenix type quarry cars at the plant of the Bound Brook Crushed Stone Co., Bound Brook, N. J., and will deliver 15 more such cars during March. Installation has also been made by the Easton company of Granby-type cars at the sand plant of Eck & Son, Montoursville, Penn.

Goodyear Tire and Rubber Co., Akron, Ohio, recently presented 15-year service pins to D. R. Barr, manager of the mechanical goods department sales, Wm. Metzler, consulting superintendent of the mechanical goods production department, and R. R. Peebles, manager of eastern division sales. These men have been connected with the mechanical goods division since its organization in 1913.

Trade Literature

NOTICE—Any publication mentioned under this heading will be sent free unless otherwise noted, to readers, on request to the firm issuing the publication. When writing for any of the items kindly mention ROCK PRODUCTS.

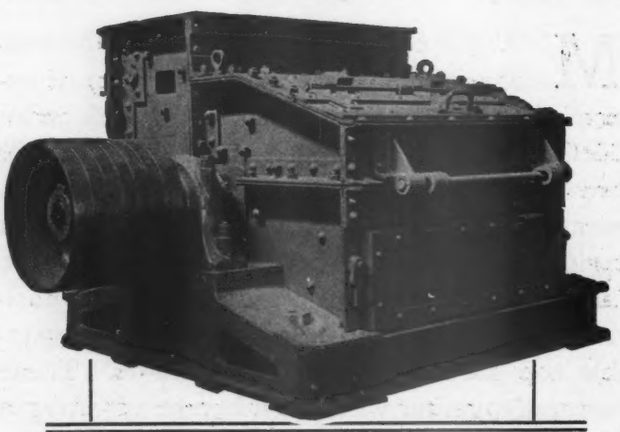
Silent Chain Drives. Illustrated handbook covering silent chain power transmission, with tables and diagrams to facilitate the selection of the proper drive. MORSE CHAIN CO., Ithaca, N. Y.

Screw Conveyors. Book No. 989, on helicoid and section-flight screw conveyors, fully illustrated with detail views and diagrams, containing 87 pages and issued as a section of Catalog No. 500. H. W. CALDWELL & SON CO., Chicago, Ill.

Cross Drum Boiler. 32-page illustrated catalog No. 65, on cross drum boilers, showing views and drawings of details of boilers, with considerable useful information on operation. EDGE MOOR IRON CO., Edge Moor, Del.

The Master Shovel. Booklet on the new 1¼-yd. gas shovel. **Whirly Bear Cat.** Booklet on full-revolving, lightweight shovel. **One-Man Crane-Shovel.** 64-page illustrated booklet on one-man, all-purpose shovel. BYERS MACHINE CO., Ravenna, Ohio.

RUGGED and RELIABLE



Built in 12 sizes for handling materials from 3 inches to 18 inches. Complete information on request.

The following features of the

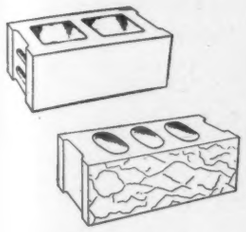
Bonnot Hammer Crusher

insure low crushing costs and uninterrupted operation over long periods.

Steel Plate Housing Strongly Reinforced
Manganese and Alloy Steel Grates and Hammers
Oversize Forged Steel Shafts
Heavy Duty Railroad Type Timken Roller Bearings
Bearings Sealed Against Dust
Ease of Access and Adjustment

THE BONNOT COMPANY
CANTON, OHIO
Chicago Office, 236 North Clark Street

A Challenge



Block

WHEREVER there is a workable deposit of sand, gravel or stone of the proper character there is a manufacturing opportunity of definite value—an opportunity to convert these raw materials into worthy building units.

Every such opportunity is a perpetual challenge to the business enterprise of the man controlling the material deposit.

The construction industry every year demands increasing millions of concrete masonry units—blocks, wall tile, brick. These units, properly made, are accepted without question.

The man who is in many respects best situated to manufacture and sell concrete building units is the man who controls a supply of sand and gravel or crushed stone.

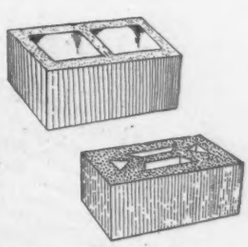
Whether he is to make blocks or brick or tile—whether he is to start with one production unit or many—these are decisions that should be made only after a thorough engineering survey of his site, his raw materials, his market.

That there are profits to be made in a properly located, well equipped concrete products plant we are prepared to demonstrate.

That the owner of a raw material deposit is in a particularly advantageous position to reap these profits can be proven, if proof is needed.

For the man who meets the challenge of opportunity, our engineers will make the necessary preliminary surveys. Consolidated represents the total experience—the total resources—of five large manufacturing organizations. We design and equip concrete products plants, large and small.

Readers of Rock Products who seek more information—facts and figures—on concrete products manufacture will incur no obligation by asking for it.



Tile

ADRIAN, MICHIGAN

When writing advertisers, please mention ROCK PRODUCTS

WORLD'S CHAMPION KILNS

built by TRAYLOR

GIANTS of the cement industry! These two Traylor-built Rotary Kilns, installed during the past year in the plant of the Phoenix Portland Cement Corp., Birmingham, Ala., are the largest in the world. They are 343 ft. 9 in. long, with diameters of 11 ft. 3 in. to 10 ft.

These are but two of the world's five largest rotary cement kilns. All five were built by Traylor. Yet not alone in size are Traylor Kilns "champions." In capacity, low power consumption and burning efficiency they are without equal.

In the SINGLE ROLLER SUPPORT the roller bearings are mounted on self-contained structural steel frames. These may be lined up on their foundations with absolute accuracy so the alignment of the shell will be perfect.

Perfect Balance—Easy on Power

Big as these kilns are, no more power is required to drive them than by many kilns much smaller in size. Actual measurement of power consumed revealed only 60 hp. to be all the power required. Traylor Single Roll Supports, which permit perfect alignment and correct balance **before** the shell is set in place, are responsible in a large degree for the remarkably small amount of power required to drive Traylor Kilns.

Traylor Products

Rotary Kilns
Dryers and Coolers
Compartment Mills
Jaw and Gyratory Crushers
Crushing Rolls
Rotary Screens
Feeders
Grizzlies
Elevators
Complete Stone, Cement, Slag and Rock Asphalt Plants

TRAYLOR ENGINEERING AND MANUFACTURING COMPANY, Allentown, Penna.

NEW YORK 30 Church St. | CHICAGO 1414 Fisher Bldg. | LOS ANGELES 362 I. W. Hellman Bldg. | SEATTLE 815 Alaska Bldg. | SALT LAKE CITY 100 W. 2nd South St.

TIMMINS, ONTARIO, CANADA. Moore Block
Export Department, 104 Pearl St., New York City—Cable Address: "Forsaltra"

Foreign Sales Agencies: London, Rangoon, Lima, Rio de Janeiro, Sao Paulo, Buenos Aires, Santiago, Valparaiso, Antofagasta, Iquique, Oruro

European Works—Usines Carels Freres, Ghent, Belgium

When writing advertisers, please mention ROCK PRODUCTS

INSLEY

SHOVEL — Ditcher — Skimmer — Dragline — CRANE

A FAIR TEST OF ABILITY

AFTER you have used an Insley Excavator a year and a half you know all there is to know about it. Pringle and Buerkle, Road Contractors of Batavia, Ohio, bought one in April, 1926, and report in October, 1927, that they "cannot say enough for this piece of machinery and are very well pleased with it."

Read what Mr. Dowdney, their superintendent, thinks about it. Compare their work with yours. Their Insley has done whatever had to be done for them, and it will do the same for you.

It costs a road contractor more to be without an Insley Excavator than to own one.

MR. DOWDNEY'S LETTER

"Regarding our Insley Excavator purchased from Mr. Handman, in April, 1926.

"This Excavator has been in almost constant use (except December and January, winter 1926-1927) since the time of purchase and we are now making our first repair on it. Repairs have been almost nothing.

"As to the motor it has never had a single part replaced.

"We have used this shovel in all kinds of work, such as rock excavation, cuts and fills, gravel loading from creek beds and cellar digging and it does its work splendidly under all conditions.

"In fact we cannot say enough for this piece of machinery and are very well pleased with it.

Very truly yours,
PRINGLE AND BUERKLE,
Wm. Dowdney, Supt."

DITCHER

SKIMMER

DRAGLINE

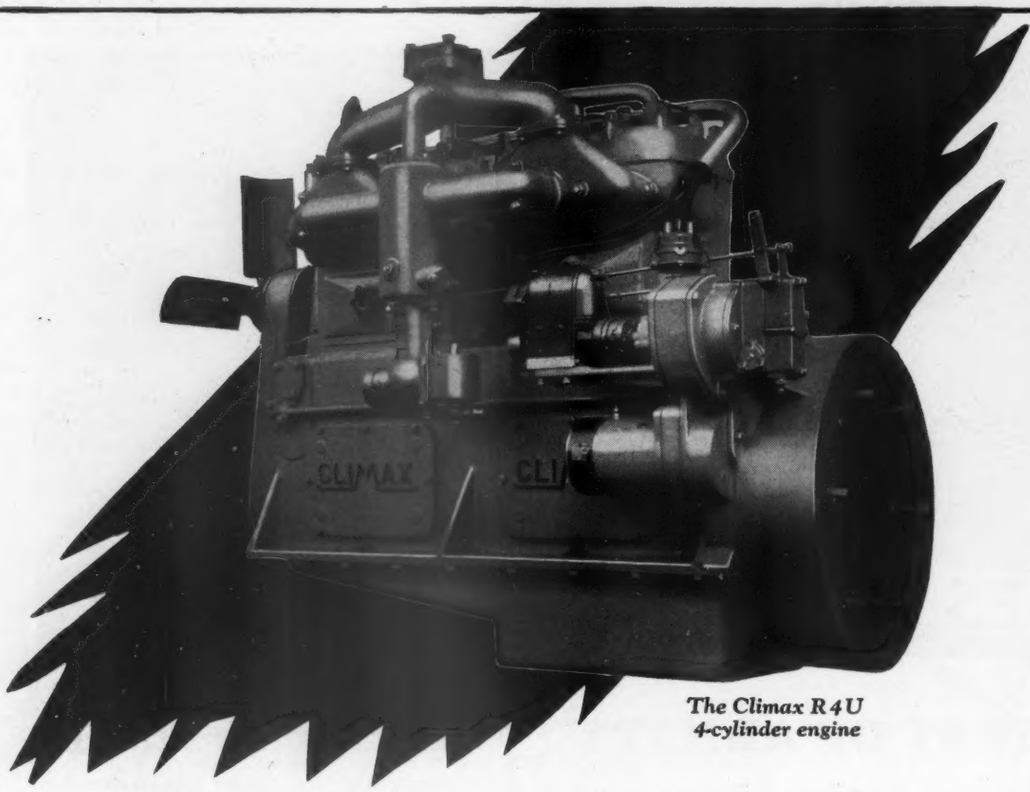
CRANE

800

INSLEY MANUFACTURING COMPANY - Indianapolis

Engineers and Manufacturers

No Feverish Throbbing



The Climax R 4 U
4-cylinder engine

THE minute the heart of your equipment starts knocking and pounding, your troubles begin, and an unhealthy engine is almost as bad as no engine at all. But you are positively protected if your equipment is powered by a Climax. Climax Engines are built with automatic spark control. This self-contained, hermetically sealed mechanical device requires no lubrication and it regulates the spark no matter how the load varies. There is no feverish throbbing of Climax cylinders—no excessive wear on the bearings and gaskets. You get constant factory-inspected performance that insures steady-flow ability month in and month out at an unusually low cost per H. P.

Climax Eliminates "Feverish Throbbing" on

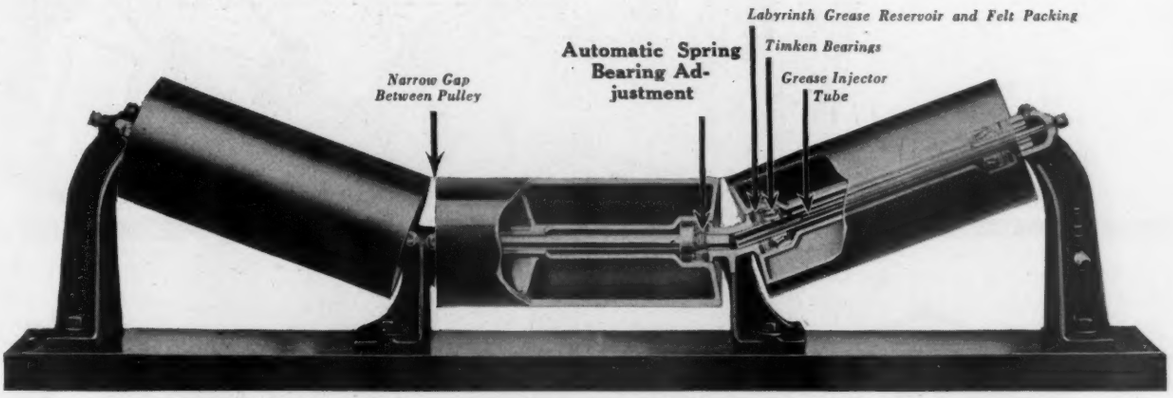
Shovels
Other Excavating Machinery
Road Rollers
Tractors
Farm Machinery
Industrial Locomotives
Locomotive Cranes
Portable Saw Mills
Compressors
Pumps
Rock Crushers
Hoists

CLIMAX ENGINEERING COMPANY, 78 W. 18th Ave., Clinton, Iowa

CLIMAX Trade Mark Reg. U. S. Pat. Off.

When writing advertisers, please mention ROCK PRODUCTS

Why Robins Anti-Friction Idlers Have *Automatic* Bearing Adjustment



ANTI-FRICTION idlers should be fool-proof. If the human element is to be eliminated anywhere, it certainly should be in the important matter of adjusting pulley bearings.

The only safe and sure method is by automatic adjustment—the method adopted for all Robins Anti-friction Idlers.

Coiled springs constantly maintain the proper pressure against the bearings, automatically compensating for even the slight wear of the rollers or races. There is no dismantling of the idler to adjust the bearings when necessary.

Refinements like these are what make Robins Idlers so popular, repeat orders definitely establishing this fact.

Let us ship you a trial order—six? twelve? a hundred?

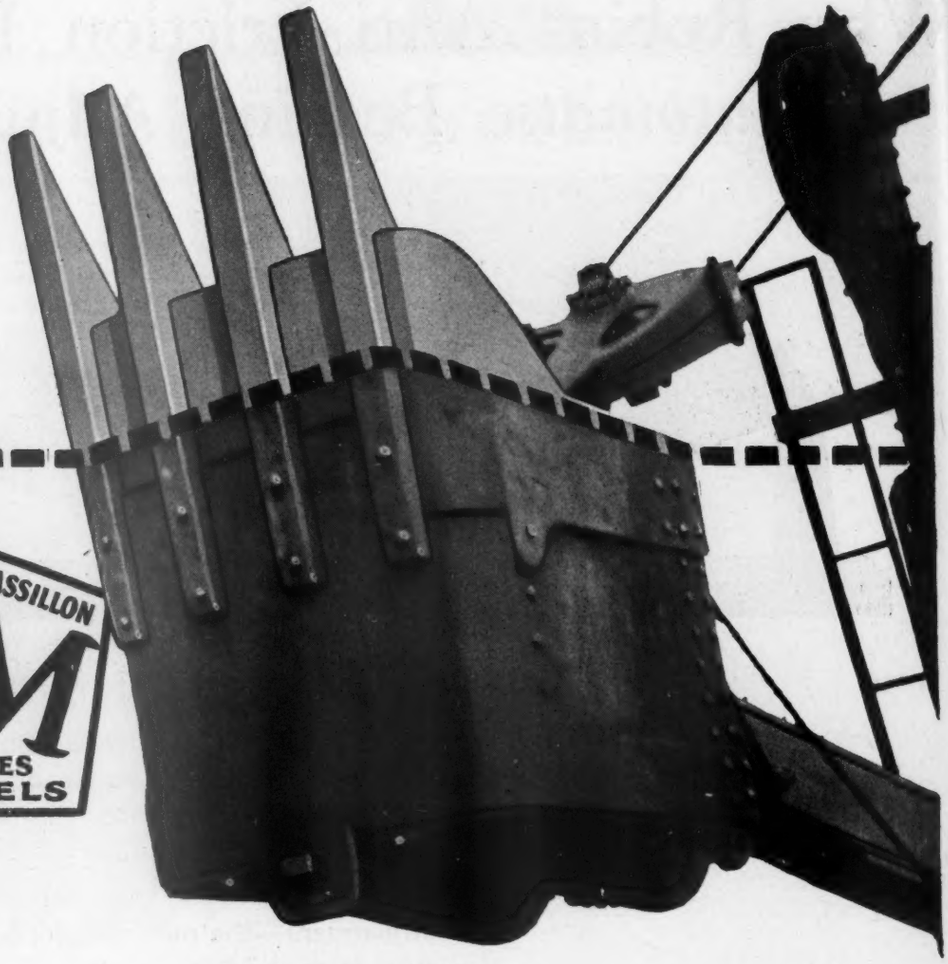
Another Feature of Robins Idlers

The gap between pulleys is less than ¼ inch, thus fully protecting the belt against damage.

ROBINS CONVEYING BELT COMPANY
15 Park Row, New York City
Chicago Boston Philadelphia Pittsburgh Los Angeles
Agents in Other Principal Cities

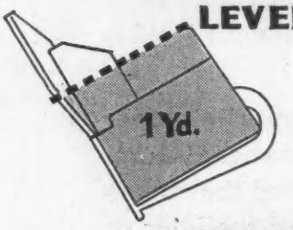
Conveying and Elevating Equipment
Sizing and Screening Equipment
Stocking and Reclaiming Systems

MATERIAL HANDLING ROBINS EQUIPMENT

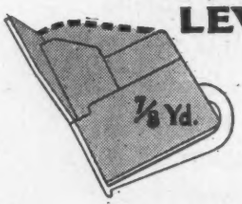


BYERS-MASSILLON
BM
CRANES
SHOVELS

1 YARD
PLATE
LEVEL.



1 YARD
WATER
LEVEL



1 YARD
HEAPED
MEASURE

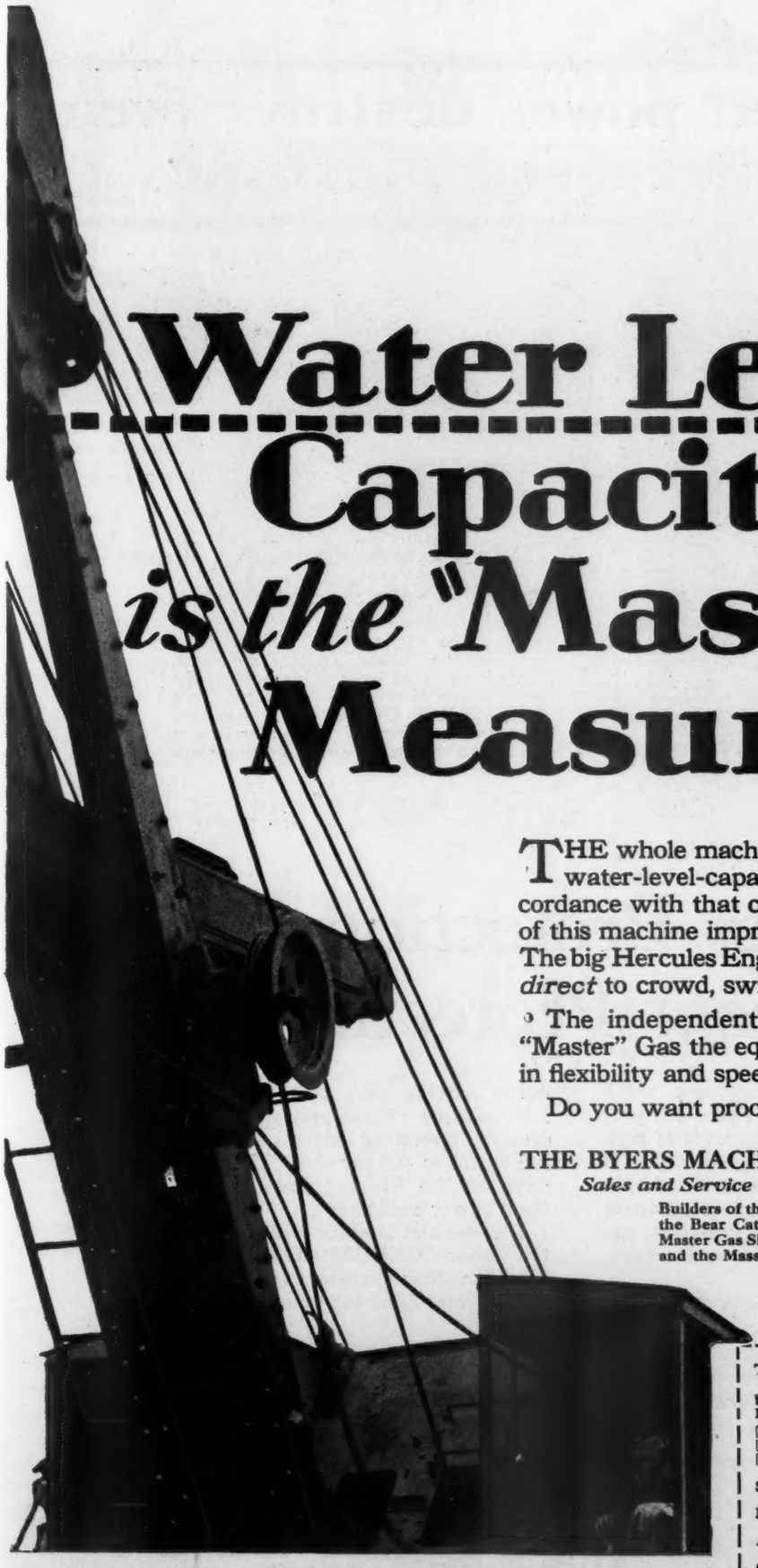
LACK of standardization in capacity measurements for buckets has lead to much confusion in the minds of shovel buyers. How are you going to know, when you are quoted a price on a 1 yard shovel, what the actual capacity of that shovel will be? The variance in standards may make a difference of 20 or 25 per cent in capacity, and almost as much in price.

Byers "Master" Shovels are rated by the most rigid standard of measurement, WATER LEVEL capacity. Be sure you know the actual capacity of the shovel you are buying, then you can judge better what you should pay for it.

BYERS "Master"

1 and 1¼ Yd.

GAS SHOVELS



Water Level Capacity is the "Master" Measure

THE whole machine back of the "Master" water-level-capacity bucket is built in accordance with that capacity. The ruggedness of this machine impresses you at every angle. The big Hercules Engine delivers ample power *direct* to crowd, swing and hoist.

The independent cable crowd makes the "Master" Gas the equal of any steam shovel in flexibility and speed.

Do you want proof? Send the coupon.

THE BYERS MACHINE CO., Ravenna, Ohio

Sales and Service Throughout the Country

Builders of the Bear Cat (½ cu. yd.)
the Bear Cat "Whirly" (⅝ cu. yd.)
Master Gas Shovels (1 and 1¼ cu. yds.)
and the Massillon Steam Shovels

The Southern Railway recently purchased two "Master" Shovels.

THE BYERS MACHINE CO., Ravenna, Ohio

Send the Booklets checked so that we may become further acquainted with The Great Byers Line.

- ☐ Byers Master Shovels, 1 and 1¼ yards.
- ☐ Byers Bear Cat, ½ yard, half-circle.
- ☐ Byers Bear Cat "Whirly," ⅝ yd., full-revolving

Signed_____

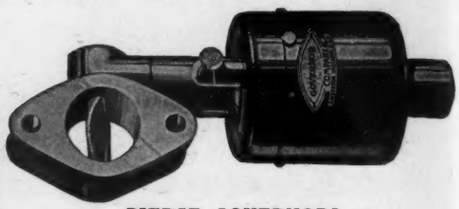
Firm_____

Address_____

City_____ State_____

RP 2-18-28

Ungoverned power destroys even the most rugged machine



PIERCE GOVERNORS are simple, rugged, dependable and fool-proof. They last a lifetime.

Barber-Greene Bucket Loaders Are PIERCE Protected

The efficient Model 42 Barber-Greene Bucket Loader, shown here, is operated by a Buda engine, the power of which is protected by a PIERCE GOVERNOR. Assuring every buyer of a Barber-Greene Loader long, dependable, economical service.

Power Protection Is *Profit* Protection

Protect your power engines with PIERCE GOVERNORS and you will protect your profits against the inroads of high repair bills and high operating costs!

Every power engine you operate should be PIERCE-equipped. Then, no matter how wide or sudden the load variation, the engine will respond with a smooth, even, steady flow of power.

This protection assures longer life for every moving part of the engine—saving fuel, cutting repair and upkeep costs, increasing operating efficiency and prolonging life by 200 to 400 per cent. That means more days on the job and greater profits from your power equipment.

Our booklet No. 120 will show you in detail what PIERCE GOVERNORS have done for other operators and what they will do for you. Send for your copy today.

PIERCE GOVERNOR COMPANY
"World's Largest Governor Builders"
ANDERSON, INDIANA

Pierce Governors *for Automatic Speed Control*

When writing advertisers, please mention ROCK PRODUCTS

YOU *SAVE* real money

Above: Photograph of dipper with AMSCO Vanderhoef Front, using Vanderhoef Shanks and ECONOMY Tips. Inset: AMSCO ECONOMY Vanderhoef DIPPER TOOTH (patented). Note relative size of tip and shank.

when your dippers are equipped with

AMSCO Economy Dipper Teeth

(Patented)

THE low first cost of ECONOMY Tips, together with the small amount of scrap metal discarded when the point is no longer fit for efficient digging, marks the AMSCO ECONOMY DIPPER TOOTH (patented) as a real money saver. On the dipper illustrated above, a new set of ECONOMY tips has just been installed after the discarded ones had dug 56,000 yards of cemented gravel and clay. The replacement cost was $19.60, whereas the replacement cost if ECONOMY tips had not been used would have been $78.00. The extreme simplicity makes possible further savings in time and labor because of the ease and speed of removal and replacement.

Because, with the use of the ECONOMY tip, it is possible to have continually sharp teeth, the loaded yardage of your shovels is increased—and this with less power than when it is necessary to use blunt teeth.

You can have sharp dipper teeth and at the same time save enough each year in the purchase price of ordinary teeth in hard digging to buy a new dipper front.

Why waste time and money on forging when Economy tips cost so little?

AMSCO ECONOMY DIPPER TEETH (patented) though new, have been successfully used in the most severe service for the last two years without breakage.

A single trial will convince you.

ECONOMY teeth are supplied in all standard bases for all types of dippers.

AMERICAN MANGANESE STEEL COMPANY

GENERAL OFFICES

1850 McCORMICK BLDG. CHICAGO, ILL.

FOUNDRIES

Chicago Heights, Ill.; New Castle, Del.; Oakland, Cal.; Los Angeles, Cal.; Denver, Colo. Southern Manganese Steel Co., St. Louis, Mo.; Burnside, Chicago, Ill.

AMSCO

When writing advertisers, please mention ROCK PRODUCTS

Classified Directory of Advertisers in this Issue of ROCK PRODUCTS

For alphabetical index, see page 160

Acetylene Generating Apparatus
Oxweld Acetylene Co.
Prest-O-Lite Co.
Prest-O-Weld

Adamite (Castings)
Mackintosh-Hemphill Co.

Aerial Wire Rope Tramways
Broderick & Bascom Rope Co.
A. Leschen & Sons Rope Co.

Agitators, Thickeners and Slurry Mixers
The Dorr Co.
Hardinge Co.
Hetherington & Berner, Inc.
Manitowoc Engineering Works
Polysius Corp.
F. L. Smidth & Co.

Air Compressors
De Laval Steam Turbine Co.
Pennsylvania Pump & Compressor Co.
Sullivan Machinery Co.
Traylor Eng. & Mfg. Co.

Air Filters
Dust Recovering & Conv. Co.

Air Pumps
Fuller Lehigh Co.

Air Separators
Dust Recovering & Conv. Co.
Rubert M. Gay Co., Inc.
Hardinge Co.
Kent Mill Co.
New Haven Sand Blast Co.
Raymond Bros. Impact Pulv. Co.
W. W. Sly Mfg. Co.
Sturtevant Mill Co.
Universal Road Machinery Co.

Alloys (Metal)
Alloy Steel & Metals Co.
Electro Metallurgical Sales Corp.

Ash and Refuse Handling Equipment
Hayward Co.

Automatic Weighers
Merrick Scale Co.

Axles
Bethlehem Steel Co.

Backfillers
Bucyrus-Erie Co.

Bags
Bemis Bro. Bag Co.
Jaite Co.

Bagging Machinery
Bemis Bro. Bag Co.

Balls (Tube Mill, etc.)
Allis-Chalmers Mfg. Co.
Fuller Lehigh Co.
Manganese Steel Forge Co.
Manitowoc Engineering Works
Polysius Corporation
W. A. Riddell Co.
F. L. Smidth & Co.

Bar Benders
Koehring Co.

Bearings
Chain Belt Co.
Hyatt Roller Bearing Co.
Webster Mfg. Co.
T. B. Wood's Sons Co.

Bearings (Anti-Friction)
Hyatt Roller Bearing Co.

Bearings (Collar Oiling)
Hyatt Roller Bearing Co.

Bearings (Tapered Roller)
Hyatt Roller Bearing Co.

Bearings (Thrust)
Hyatt Roller Bearing Co.

Belting
B. F. Goodrich Rubber Co.
Goodyear Tire & Rubber Co.
Robins Conveying Belt Co.
F. M. Welch Eng. Serv.

Bins (Cement, etc.)
Burrell Eng. & Const. Co.
Galland-Henning Mfg. Co.
Hetherington & Berner, Inc.
Manitowoc Engineering Works
Traylor Eng. & Mfg. Co.
Universal Crusher Co.
Webster Mfg. Co.

Bin Gates
Austin Mfg. Co.
R. H. Beaumont Co.
Easton Car & Construction Co.
Fuller Lehigh Co.
Galland-Henning Mfg. Co.
Gruendler Patent Crusher & Pulverizer Co.
Industrial Brownhoist Corp.
Link-Belt Co.
Manitowoc Engineering Works
Smith Engineering Works
Stephens-Adamson Mfg. Co.
Traylor Eng. & Mfg. Co.

Blast Hole Drills (See Drills)

Blasting Machines
Hercules Powder Co.

Blasting Powder
Hercules Powder Co.

Blasting Supplies
Hercules Powder Co.

Block Machines (Concrete)
Consolidated Concrete Mach. Co.
W. A. Riddell Co.

Blocks (Pillow)
Hyatt Roller Bearing Co.

Blocks (Sheave)
R. H. Beaumont Co.
Dobbie Foundry & Machine Co.
Sauerman Bros.

Blowers
De Laval Steam Turbine Co.

Blowpipes
Manitowoc Engineering Co.
Oxweld Acetylene Co.
Prest-O-Lite Co.
Prest-O-Weld

Bodies (Motor Truck)
Easton Car & Construction Co.

Boilers (Water Tube)
Jackson & Church Co.

Brick Hardening Cylinders
Komnick Machinery Co.

Brick (Insulating)
General Refractories Co.

Brick Loading Apparatus
Komnick Machy. Co.

Brick Machinery (Sand Lime and Slag)
Jackson & Church Co.
Komnick Machy. Co.
W. A. Riddell Co.

Bucket Conveyors (See Conveyors and Elevators)

Buckets (Dragline)
R. H. Beaumont Co.
Page Engineering Co.
Sauerman Bros.

Buckets (Elevator and Conveyor)
American Manganese Steel Co.
Chain Belt Co.
Galland-Henning Mfg. Co.
Gruendler Patent Crusher & Pulverizer Co.
Hayward Co.
Hendrick Mfg. Co.
Industrial Brownhoist Corp.
Jeffrey Mfg. Co.
Link-Belt Co.
Manganese Steel Forge Co.
Polysius Corporation
Robins Conveying Belt Co.
Smith Engineering Works
Stephens-Adamson Mfg. Co.
W. Toepfer & Sons Co.
Webster Mfg. Co.

Buckets (Grab, Clamshell, etc.)
American Manganese Steel Co.
Browning Crane Co.
Hayward Co.
Industrial Brownhoist Corp.
Link-Belt Co.
Owen Bucket Co.
Page Engineering Co.

Buhr Mills
J. B. Ehrsam & Sons Mfg. Co.
Sturtevant Mill Co.

Buildings
H. K. Ferguson Co.

Cables (Electrical)
John A. Roebling's Sons Co.

Cableways
R. H. Beaumont Co.
Broderick & Bascom Rope Co.
Dobbie Foundry & Machine Co.
S. Flory Mfg. Co.
General Electric Co.
Hayward Co.
Interstate Equipment Corp.
Link-Belt Co.
Mundy Sales Corp.
Page Engineering Co.
Sauerman Bros.

Calcining Kettles (Gypsum)
Butterworth & Lowe
J. B. Ehrsam & Sons Mfg. Co.

Caps (Blasting, Electric & Delay Electric)
Hercules Powder Co.

Car Pullers
Bethlehem Steel Co.
Dobbie Foundry & Machine Co.
Mundy Sales Corp.
Stephens-Adamson Mfg. Co.
Webster Mfg. Co.

Carriers
Stephens-Adamson Mfg. Co.

Cars (Dump)
Austin Mfg. Co.
Easton Car & Construction Co.
Kentucky Wagon Mfg. Co.
Link-Belt Co.
Woodford Engineering Works

Cars (Quarry and Gravel Pit)
Atlas Car & Mfg. Co.
Bethlehem Steel Co.
Consolidated Concrete Mach. Co.
Easton Car & Construction Co.
Gruendler Patent Crusher & Pulverizer Co.
Manitowoc Engineering Works

Castings
Alloy Steel & Metals Co.
Bethlehem Steel Co.
Fuller Lehigh Co.
Hetherington & Berner, Inc.
Link-Belt Co.
Mackintosh-Hemphill Co.
Vulcan Iron Works

Cement (High Temperature)
General Refractories Co.

Cement Pumps (See Pumps, Air Pumps)

Chain (Dredge and Steam Shovel)
Jeffrey Mfg. Co.
Manganese Steel Forge Co.
S. G. Taylor Chain Co.

Chain (Elevating and Conveying)
American Manganese Steel Co.
Chain Belt Co.
Philadelphia Gear Works
Stephens-Adamson Mfg. Co.
Webster Mfg. Co.

Chain (Steam Shovel)
Bucyrus-Erie Co.

Chain Drives
Chain Belt Co.
Link-Belt Co.

Chain Links (Cold Sheet, Repair, etc.)
Bucyrus-Erie Co.
S. G. Taylor Chain Co.

Chemists
Robert W. Hunt Co.

Chutes and Chute Liners
Mackintosh-Hemphill Co.
F. L. Smidth & Co.
Webster Mfg. Co.

Clamshell Buckets—See Buckets (Grab, Clamshell, etc.)

Clamshell Cranes (See Cranes)

Clarifiers
The Dorr Co.

Classifiers
The Dorr Co.

Clay Working Machinery
Bonnot Co.
Mackintosh-Hemphill Co.

Clips (Wire Rope)
Broderick & Bascom Rope Co.

Clutches (Magnetic)
Magnetic Mfg. Co.

Coal Pulverizing Equipment
Allis-Chalmers Mfg. Co.
Bethlehem Steel Co.
Bonnot Co.
Bradley Pulverizer Co.
Fuller Lehigh Co.
Rubert M. Gay Co., Inc.
Hardinge Co.
Pennsylvania Crusher Co.
Polysius Corporation
Raymond Bros. Impact Pulv. Co.
F. L. Smidth & Co.
Vulcan Iron Works

Cocks (Lubricated-Acid-Proof)
Merco Nordstrom Valve Co.

Compressors
Pennsylvania Pump & Compressor Co.

Concentrators (Slurry)
The Dorr Co.

Concrete Block Machines (See Block Machines)

Concrete Breakers (Pneumatic)
Sullivan Machinery Co.

Concrete Mixers
Consolidated Concrete Mach. Co.

Contractors and Builders
Burrell Eng. & Const. Co.
H. K. Ferguson Co.
E. J. Longyear Co.

Conveying Belting (See Belting)

Conveyors (Monorail)
Cleveland Crane & Eng. Co.

Conveyors and Elevators
Austin Mfg. Co.
R. H. Beaumont Co.
Chain Belt Co.
Consolidated Concrete Mach. Co.
Fuller Co.
Galland-Henning Mfg. Co.
Hayward Co.
Huron Industries, Inc.
Industrial Brownhoist Corp.
Jeffrey Mfg. Co.
Link-Belt Co.
Manganese Steel Forge Co.
Robins Conveying Belt Co.
F. L. Smidth & Co.
Smith Engineering Works
Stephens-Adamson Mfg. Co.
Sturtevant Mill Co.
W. Toepfer & Sons Co.
Traylor Eng. & Mfg. Co.
Universal Crusher Co.
Universal Road Machinery Co.
Webster Mfg. Co.
F. M. Welch Eng. Serv.

Coolers (See Kilns and Coolers, Rotary)

Core Drilling (See Drills—Diamond Core)

Manitowoc Heavy Duty Kilns Show Big Savings

BECAUSE Manitowoc Kiln operation is continuous, because it shows big and substantial savings, because it is heavily constructed — it has become the popular choice of cement mills throughout the country.

Above shows one section of a Manitowoc Kiln 86′ x 10′ 6″ outside dimensions. This Kiln was recently completed and is now being installed in a large mill.

Regardless of diameter, length, whether it be for wet or dry process, with or without waste heat boilers — you can get a Manitowoc Kiln for any service.

Let us quote on your requirements.

Send for Cement Bulletin — it completely pictures and describes Manitowoc Cement Mill equipment. It costs you nothing but the asking. Write for it today!

MANITOWOC ENGINEERING WORKS
MANITOWOC, WISCONSIN

Cement Mill Equipment

Flue Dust Feeders
Rotary Kilns
Rotary Coolers
Rotary Dryers
Minogue Slurry Agitators
Tube Mills
Slugs for Tube Mill Grinding Media

MANITOWOC

Classified Directory of Advertisers in this Issue of ROCK PRODUCTS

For alphabetical index, see page 160

Correcting Basins
F. L. Smidth & Co.

Couplings (Flexible and Shaft)
Chain Belt Co.
De Laval Steam Turbine Co.
Huron Industries, Inc.
Philadelphia Gear Works

Couplings (Hose, Pipe, etc.)
B. F. Goodrich Rubber Co.
Goodyear Tire & Rubber Co., Inc.

Cranes (Crawler and Locomotive)
Atlas Car & Mfg. Co.
Browning Crane Co.
Bucyrus-Erie Co.
Byers Machine Co.
Harnischfeger Corp. (Pawling & Harnischfeger)
Industrial Brownhoist Corp.
Insley Mfg. Co.
Koehring Co.
Link-Belt Co.
Ohio Locomotive Crane Co.
Thew Shovel Co. (Electric, Gasoline & Steam

Cranes (Gantry)
Cleveland Crane & Eng. Co.
Harnischfeger Corp. (Pawling & Harnischfeger)
Hayward Co.

Cranes (Overhead, Traveling, Electric, etc.)
Cleveland Crane & Eng. Co.
Harnischfeger Corp. (Pawling & Harnischfeger)
Northern Engineering Works

Crusher Protectors
Magnetic Mfg. Co.

Crushers (Hammer)
Dixie Machinery Mfg. Co.
Pennsylvania Crusher Co.
Sturtevant Mill Co.

Crushers (Jaw and Gyratory)
Allis-Chalmers Mfg. Co.
Alloy Steel & Metals Co.
Austin Mfg. Co.
Butterworth & Lowe
Galland-Henning Mfg. Co.
Gruendler Patent Crusher & Pulverizer Co.
Mackintosh-Hemphill Co.
Polysius Corporation
Smith Engineering Works
Sturtevant Mill Co.
Symons Bros. Co.
Traylor Eng. & Mfg. Co.
Universal Crusher Co.
Universal Road Machy. Co.

Crushers (Rotary)
Butterworth & Lowe
J. B. Ehrsam & Sons Mfg. Co.
Jackson & Church Co.
Polysius Corporation
Sturtevant Mill Co.

Crushers (Single Roll)
Jeffrey Mfg. Co.
Link-Belt Co.
McLanahan-Stone Machine Co.

Crushing Rolls
Allis-Chalmers Mfg. Co.
American Manganese Steel Co.
Galland-Henning Mfg. Co.
Jeffrey Mfg. Co.
Mackintosh-Hemphill Co.
Polysius Corporation
Sturtevant Mill Co.
Traylor Eng. & Mfg. Co.

Cupolas
Northern Engineering Works

Cutter Heads
Hetherington & Berner, Inc.

Cutting Apparatus
Oxweld Acetylene Co.
Prest-O-Lite Co.
Prest-O-Weld

Derricks and Derrick Fittings
Dobbie Foundry & Machine Co.
S. Flory Mfg. Co.
Hayward Co.
Mundy Sales Corp.

Dewatering Machines
The Dorr Co.

Diamond Core Drilling (See Drills, Diamond Core)

Diesel Engines (See Engines, Diesel)

Dippers and Teeth (Steam Shovel)
American Manganese Steel Co.
Bucyrus-Erie Co.
Hayward Co.
Thew Shovel Co. (Steam Shovel)

Ditchers
Hayward Co.
Insley Mfg. Co.

Draglines
Bucyrus-Erie Co.
Harnischfeger Corp. (Pawling & Harnischfeger)
Insley Mfg. Co.
Koehring Co.
Link-Belt Co.
Monighan Machine Co.
Page Engineering Co.
Thew Shovel Co.

Dragline Excavators
Hayward Co.
Monighan Machine Co.
Page Engineering Co.
Thew Shovel Co. (Electric, Gasoline & Steam)

Dragline Cableway Excavators
R. H. Beaumont Co.
Browning Crane Co.
Bucyrus-Erie Co.
Dobbie Foundry & Machine Co.
L. P. Green
Link-Belt Co.
Mundy Sales Corp.
Novo Engine Co.
Page Engineering Co.
Sauerman Bros.

Dredge Chain (See Chain)

Dredge Pipe (See Pipe)

Dredges
Bucyrus-Erie Co.
Dobbie Foundry & Machine Co.
S. Flory Mfg. Co.
Hayward Co.
Hetherington & Berner, Inc.
Manitowoc Engineering Works
Mundy Sales Corp.
F. M. Welch Eng. Serv.

Drill Sharpening Machines
Sullivan Machinery Co.

Drill Steel
Bethlehem Steel Co.

Drilling Accessories
Loomis Machine Co.

Drills (Blast Hole)
Armstrong Mfg. Co.
Loomis Machine Co

Drills (Diamond Core)
E. J. Longyear Co.
Loomis Machine Co.
Sullivan Machinery Co.

Drills, Hammer (See Hammer Drills)

Drills (Rock)
Sullivan Machinery Co.

Drills (Well)
Loomis Machine Co.

Drives (See Gears, Chain Drives, etc.)

Drives (Worm)
Cleveland Worm & Gear Co.

Drums (Magnetic)
Magnetic Mfg. Co.

Dryers
Allis-Chalmers Mfg. Co.
Bonnot Co.
Fuller Lehigh Co.
Galland-Henning Mfg. Co.
McGann Mfg. Co., Inc.
Manitowoc Engineering Works
Polysius Corporation
Raymond Bros. Impact Pulv. Co.
W. A. Riddell Co.
Ruggles-Coles Div. of Hardinge Co., Inc.
Traylor Eng. & Mfg. Co.
Vulcan Iron Works

Dust Arresters
Dust Recovering & Conv. Co.
New Haven Sand Blast Co.
Pangborn Corp.
W. W. Sly Mfg. Co.

Dust Blowers
Dust Recovering & Conv. Co.

Dust Collecting Systems
Allis-Chalmers Mfg. Co.
Dust Recover'g & Conveying Co.
New Haven Sand Blast Co.
Pangborn Corp.
W. W. Sly Mfg. Co.

Dust Conveying Systems
Dust Recovering & Conveying Co.
Fuller Co.

Dynamite
Hercules Powder Co.

Electric Haulage Systems
Woodford Engineering Co.

Electric Power Equipment
Allis-Chalmers Mfg. Co.
General Electric Co.

Electro Magnets
Magnetic Mfg. Co.

Elevator Belting (See Belting)

Elevator Buckets (See Buckets—Elevator)

Elevators (See Conveyors and Elevators)

Emery Mills
Sturtevant Mill Co.

Engineers
Bollinger-Andrews Const. Co.
Bonnot Co.
Burrell Eng. & Const. Co.
The Dorr Co.
Dust Recover'g & Conveying Co.
H. K. Ferguson Co.
Fuller Lehigh Co.
Hetherington & Berner, Inc.
Robt. W. Hunt Co.
Kritzer Co.
E. J. Longyear Co.
Manitowoc Engineering Works
H. Miscampbell
F. L. Smidth & Co.
Sturtevant Mill Co.
Webster Mfg. Co.
F. M. Welch Eng. Serv.
R. D. Wood & Co.

Engine Governors
Pierce Governor Co.

Engines (Diesel)
Bethlehem Steel Co.
Power Mfg. Co.

Engines (Gasoline, Kerosene and Oil)
Armstrong Mfg. Co.
Buda Co.
Climax Engineering Co.
Dobbie Foundry & Machine Co.
Hercules Motors Corp.
Le Roi Company
Mundy Sales Corp.
Novo Engine Co.
Power Mfg. Co.
Wisconsin Motor Mfg. Co.

Engines (Steam)
Dobbie Foundry & Machine Co.
Mundy Sales Corp.

Excavating Machinery (See Shovels, Cranes, Buckets, etc.)

Explosives
Hercules Powder Co.

Fans
General Electric Co.
Vulcan Iron Works

Fans (Exhaust)
Jeffrey Mfg. Co.
New Haven Sand Blast Co.
W. W. Sly Mfg. Co.

Feeders
Robins Conveying Belt Co.

Filters (Air)
Dust Recovering & Conv. Co.

Filters (Oil)
S. F. Bowser & Co., Inc.

Fire Brick
General Refractories Co.

Flux
Oxweld Acetylene Co.
Prest-O-Lite Co.
Prest-O-Weld

Forgings
Alloy Steel & Metals Co.
Manganese Steel Forge Co.

Frogs and Switches
American Manganese Steel Co.
Bethlehem Steel Co.
Easton Car & Construction Co.
Morrison & Risman

Furnaces
Raymond Bros. Impact Pulv. Co.
Sullivan Machinery Co.

Fuses
General Electric Co.

Gaskets
B. F. Goodrich Rubber Co.
Goodyear Tire & Rubber Co., Inc.

Gasoline Engines—(See Engines, Gasoline, Kerosene and Oil)

Gasoline Tanks (See Tanks—Gasoline)

Gas Producers
R. D. Wood & Co.

Gauges
Oxweld Acetylene Co.
Prest-O-Lite Co.
Prest-O-Weld

Gears (Machine Molded)
Vulcan Iron Works

Gears (Spur, Helical, Worm)
Cleveland Worm & Gear Co.
De Laval Steam Turbine Co.
Horsburgh & Scott Co.
Jeffrey Mfg. Co.
R. D. Nuttall Co.
Philadelphia Gear Works

Gears and Pinions
American Manganese Steel Co.
Chain Belt Co.
General Electric Co.
Horsburgh & Scott Co.
Mackintosh-Hemphill Co.
Philadelphia Gear Works
Stephens-Adamson Mfg. Co.
Vulcan Iron Works

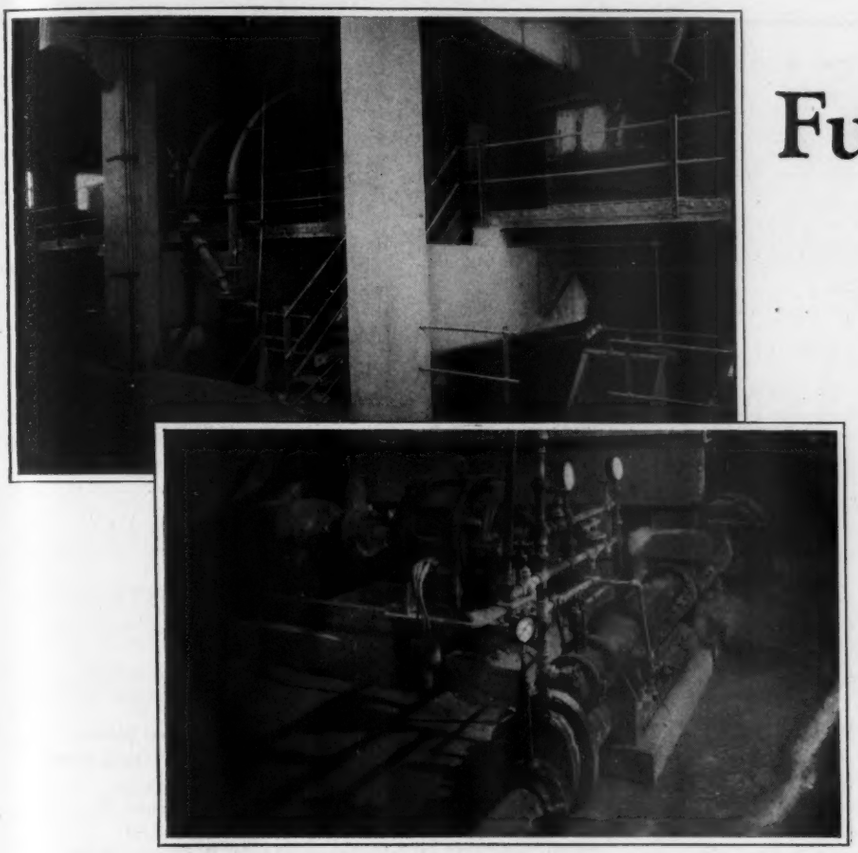
Gear Reducers
Cleveland Worm & Gear Co.
Horsburgh & Scott Co.
Huron Industries, Inc.
Philadelphia Gear Works

Generators (See Motors and Generators)

Generators (Acetylene)
Oxweld Acetylene Co.
Prest-O-Lite Co.
Prest-O-Weld

Gloves
Oxweld Acetylene Co.
Prest-O-Lite Co.
Prest-O-Weld

The Modern Low Cost Way to Convey, Elevate and Distribute Pulverized Materials



Fuller-Kinyon System delivering cement to Packing Bins. Note the cross over to the Transport line of another system

Fuller-Kinyon Systems

for handling materials such as:

CEMENT, RAW MATERIAL, FLUE DUST, PULVERIZED LIMESTONE, CAUSTIC AND HYDRATED LIME, RAW AND CALCINED GYPSUM, PHOSPHATE ROCK, TALC, CHALK BAUXITE, ETC.

ONE of the advantages of the Fuller-Kinyon System that contributes to its total economy is the complete flexibility in layout and the ease with which it can be adapted to materials handling problems in either old or new plants. The system shown above is one of a number installed several years ago in extending and improving a large eastern plant. In an editorial describing this plant, that appeared in a prominent trade journal, it was said: "In both the old and new packing plants, the system of transporting and handling cement is the same. Fuller-Kinyon pumps take the cement from the finish grinding mills and pump it to either the storage house or the silos. The screw conveyors, underneath the silos, take it to the Pack House. In the newer plant Fuller-Kinyon pumps are also used to fill the Packing Bins and transport cement from one silo to another whenever this is necessary. The two systems of pumping are so inter-connected that either cannot be described by itself but the following description is merely concerned with the new plant." This is one illustration of what we mean by "flexibility," inter-connected systems, similar equipment in both old and new parts of the plant and, simplicity of control in the distribution of the material.

Fuller-Kinyon Systems have made possible expansion of old plants where lack of space would otherwise have precluded the installation of additional machinery.

FULLER COMPANY

Catasauqua, Pa. **U. S. A.**

When writing advertisers, please mention ROCK PRODUCTS

Classified Directory of Advertisers in this Issue of ROCK PRODUCTS

For alphabetical index, see page 160

Goggles
Oxweld Acetylene Co.
Prest-O-Lite Co.
Prest-O-Weld

Governors (See Engine Governors)

Grab Bucket Cranes (See Cranes)

Grab Bucket Hoists (Monorail) (See Cranes)

Grab Buckets—See Buckets (Grab, Clamshell, etc.)

Graphite Facings
Joseph Dixon Crucible Co.

Graphite (Lubricating)
Acheson Graphite Co.

Graphite Powders
Acheson Graphite Co.

Grapples
Hayward Co.

Grapples (Wood)
Browning Crane Co.

Grating
Kerlow Steel Flooring Co.

Grease
Acheson Graphite Co.
Adam Cook's Sons Co.
S. F. Bowser & Co., Inc.
Joseph Dixon Crucible Co.
Merco Nordstrom Valve Co. (Valve)
Troco Lubricating Co.

Grinding Balls
Fuller Lehigh Co.
Jeffrey Mfg. Co.
Sturtevant Mill Co.

Grizzlies
Austin Manufacturing Co.
Manganese Steel Forge Co.
Robins Conveying Belt Co.
Smith Engineering Works
Stephens-Adamson Mfg. Co.
Traylor Eng. & Mfg. Co.

Gypsum Plaster Plants
Butterworth & Lowe
J. B. Ehrsam & Sons Mfg. Co.

Gyrating Screens (See Screens)

Hammer Mills (See Crushers)

Hand Shovels (See Shovels)

Haulage Systems (Electric)
Woodford Engineering Co.

Hoists
Cleveland Crane & Eng. Co.
Dobbie Foundry & Machine Co.
S. Flory Mfg. Co. (Electric, Steam and Gasoline)
L. P. Green
Harnischfeger Corp. (Pawling & Harnischfeger)
Hayward Co.
Hyman-Michaels Co.
Jackson & Church Co.
Link-Belt Co.
Mundy Sales Corp.
Northern Engineering Works, (Electric, Traveling)
Novo Engine Co.
Sauerman Bros.
Smith Engineering Works
Sullivan Machinery Co. (Portable Air, Electric and Steam)
Vulcan Iron Works

Hooks
S. G. Taylor Chain Co.

Hoppers and Spouts
Manganese Steel Forge Co.

Hose Couplings (See Couplings)

Hose (Water, Steam, Pneumatic and Air Drill)
B. F. Goodrich Rubber Co.
Goodyear Tire & Rubber Co., Inc.

Hose (Welding)
Prest-O-Lite Co.
Prest-O-Weld

Hydrators (Lime)
Jackson & Church Co.
Kritzer Co.
McGann Mfg. Co., Inc.
H. Miscampbell
Vulcan Iron Works

Hydraulic Guns (See Guns, Hydraulic)

Injectors
Penberthy Injector Co.

Insulation (Electric)
General Electric Co.

Insulation (Heat)
General Refractories Co.

Kiln Insulation
General Refractories Co.

Kiln Liners
General Refractories Co.

Kilns and Coolers (Rotary)
Allis-Chalmers Mfg. Co.
Bonnot Co.
Hardinge Co.
Manitowoc Engineering Works
McGann Mfg. Co., Inc.
Polysius Corporation
F. L. Smidth & Co.
Traylor Eng. & Mfg. Co.
Vulcan Iron Works

Kilns (Shaft)
Manitowoc Engineering Works
McGann Mfg. Co., Inc.
H. Miscampbell
Vulcan Iron Works

Kominuters (See Mills)

Laboratory Crushers
Sturtevant Mill Co.

Lead Burning Apparatus
Oxweld Acetylene Co.
Prest-O-Lite Co.
Prest-O-Weld

Lime Handling Equipment
Dust Recovering & Conv. Co.
Fuller Co.
Kritzer Co.
Link-Belt Co.
McGann Mfg. Co., Inc.
H. Miscampbell
Raymond Bros. Impact Pulv. Co.
Sturtevant Mill Co.

Lime and Hydrating Plants
McGann Mfg. Co., Inc.
Vulcan Iron Works

Line Shaft Couplings
Chain Belt Co.
Huron Industries, Inc.
Philadelphia Gear Works

Linings (See Mill Liners & Linings)

Linings (Rubber for Ball and Tube Mills)
B. F. Goodrich Rubber Co.

Loaders and Unloaders
Bucyrus-Erie Co.
Consolidated Concrete Mach. Co.
Dust Recovering & Conv. Co.
L. P. Green
Harnischfeger Corp. (Pawling & Harnischfeger)
Hayward Co.
Jeffrey Mfg. Co.
Link-Belt Co.

Locomotive Cranes (See Cranes)

Locomotives (Steam, Gas and Electric)
Fate-Root-Heath Co. (Gas)
General Electric Co.
Hyman-Michaels Co.
Jeffrey Mfg. Co.
Lima Locomotive Works (Steam)
Plymouth Locomotive Works (Gas)
Vulcan Iron Works

Locomotives (Storage Battery)
Atlas Car & Mfg. Co.
General Electric Co.
Jeffrey Mfg. Co.

Lubricants
Acheson Graphite Co.
Broderick & Bascom Rope Co. (Wire Rope)
Adam Cook's Sons Co.
Joseph Dixon Crucible Co.
Merco Nordstrom Valve Co. (Valve)
Troco Lubricating Co.

Lubricating Systems
S. F. Bowser & Co., Inc.
Penberthy Injector Co.

Lubricators
S. F. Bowser & Co., Inc.

Machinery Guards
Harrington & King Perforating Co.

Magnetic Pulleys
Magnetic Mfg. Co.

Magnetos
Eisemann Magneto Corp.

Magnets
General Electric Co.
Magnetic Mfg. Co.

Manganese Steel (Plates and Sheets)
Manganese Steel Forge Co.

Manganese Steel Castings
Alloy Steel & Metals Co.
American Manganese Steel Co.

Manganese Steel Products (Rolled or Forged)
Electro Metallurgical Sales Corp.
Manganese Steel Forge Co.

Manifolds
Prest-O-Lite Co.

Mechanical Rubber Goods
B. F. Goodrich Rubber Co.

Metal (Alloys, See Alloys, Babbitt Metal, Manganese Steel, Steel, etc.)

Mills, Grinding (Ball, Tube, etc.) (See also Crushers, Hammer)
Allis-Chalmers Mfg. Co.
Bethlehem Steel Co.
Bonnot Co.
Bradley Pulverizer Co.
Fuller Lehigh Co.
Hardinge Co.
Jackson & Church Co.
Mackintosh-Hemphill Co.
Raymond Bros. Impact Pulv. Co.
F. L. Smidth & Co.
Sturtevant Mill Co.
Traylor Eng. & Mfg. Co.

Mill Liners and Linings (Iron for Ball and Tube Mills)
American Manganese Steel Co.
Fuller Lehigh Co.
Jeffrey Mfg. Co.
F. L. Smidth & Co.

Mill Lining (Rubber for Ball and Tube Mills)
B. F. Goodrich Rubber Co.

Mine Developing
E. J. Longyear Co.

Mining Engineers (See Engineers)

Molds (Concrete)
Consolidated Concrete Mach. Co.

Monorail Systems
Cleveland Crane & Eng. Co.

Motors (Gasoline)
Climax Engineering Co.
Le Roi Company

Motors and Generators (Electric)
Allis-Chalmers Mfg. Co.
General Electric Co.

Oil Burning Apparatus
Raymond Bros. Impact Pulv. Co.

Oil Filters
S. F. Bowser & Co., Inc.

Ore Jigs
McLanahan-Stone Machine Co.

Oxy-Acetylene Apparatus
Oxweld Acetylene Co.
Prest-O-Lite Co.
Prest-O-Weld

Packings (Pump, Valve, etc.)
B. F. Goodrich Rubber Co.
Goodyear Tire & Rubber Co., Inc.

Paint
Joseph Dixon Crucible Co.

Pavers
Koehring Co.

Perforated Metal
Chicago Perforating Co.
Cross Engineering Co.
Harrington & King Perforating Co.
Hendrick Mfg. Co.
W. Toepfer & Sons Co.

Pile Drivers
Browning Crane Co.
Bucyrus-Erie Co.
Harnischfeger Corp. (Pawling & Harnischfeger)

Pins and Bushings (Forged Manganese Steel)
Manganese Steel Forge Co.

Pipe
Manganese Steel Forge Co. (Rolled Manganese Dredge Pipe)
R. D. Wood & Co.

Plug Valves (See Valves)

Pneumatic Drills (See Drills)

Poidometers
Schaffer Poidometer Co.

Portable Conveyors
Austin Manufacturing Co.
Fuller Co.
Link-Belt Co.
Stephens-Adamson Mfg. Co.

Portable Engines
Climax Engineering Co.
Le Roi Company

Portable Loaders
Jeffrey Mfg. Co.

Power Units
Climax Engineering Co.
Hercules Motors Corp.
Le Roi Company
Power Mfg. Co.
Wisconsin Motor Mfg. Co.

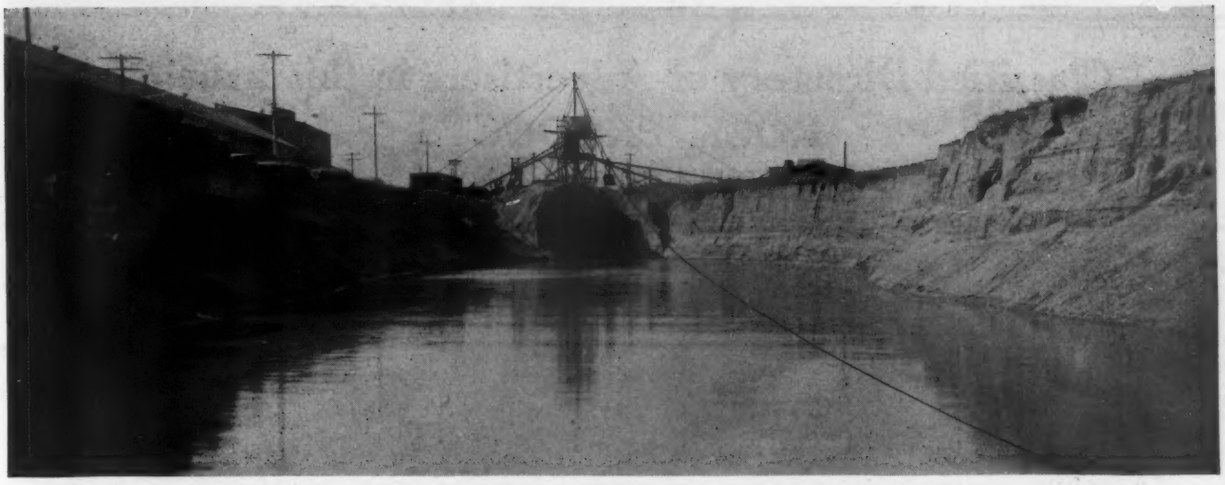
Pulleys
Huron Industries, Inc.

Pulleys (Friction Clutch)
Power Mfg. Co.

Pulleys (Magnetic) (See Magnetic Pulleys)

Pulverizers (See also Crushers, Mills, etc.)
Allis-Chalmers Mfg. Co.
Bethlehem Steel Co.
Bonnot Co.
Bradley Pulverizer Co.
Dixie Machinery Mfg. Co.
Fuller Lehigh Co.
Gruendler Patent Crusher & Pulverizer Co.
Hardinge Co.
Jeffrey Mfg. Co.
Kent Mill Co.
Raymond Bros. Impact Pulv. Co.
F. L. Smidth & Co.
Sturtevant Mill Co.
Universal Crusher Co.

Pumps (Air Lift)
Fuller Co.
Pennsylvania Pump & Compressor Co.
Sullivan Machinery Co.



Over a Yard of Gravel Per Minute From 100 Feet Under Water

SEVERAL years ago a sand and gravel operator near Roxbury, Massachusetts, installed a 1½ cubic yard, 600-ft. span Sauerman Slackline Cableway to handle his digging—to produce about 700 yards per day.

At that time the excavating was in dry material. But as time passed and the pit became deeper and deeper, water started to come in.

This, however, had no effect on the Sauerman Cableway. It kept right on digging its 700 yards per day as required, day in and day out.

Now the entire deposit of this plant is covered by 100 feet of water. And still the Sauerman Cableway digs its 700 yards per nine hour day—better than a yard of gravel every minute. It works steadily, and produces at a lower cost per yard than any other equipment that could handle the job.

It digs, conveys, and elevates all in one operation without the use of intermediate machinery.

It digs under water and in wet, sticky material as well as in loose material or hard ground.

Because it can handle such a variety of excavating, the Sauerman Slackline Cableway is becoming more and more widely used by gravel producers all over the country as well as by contractors for nearly all kinds of excavating.

Sauerman Cableway buckets range in size from 1/3 to 3½ cubic yards capacity and operating spans range from 200 to 1200 ft. in length.

There are a number of interesting articles on the work of the Sauerman Slackline Cableway in this month's **Sauerman News.** Send for your copy today. You'll find it mighty interesting.

This illustration of a Sauerman Slackline bucket, conveying a load of wet gravel that it has lifted from deep under water, is typical of the heaping loads these buckets handle. There is easily 1¾ yd., probably more, material packed into the 1½ yd. bucket in the picture.

SAUERMAN BROS., Inc., 430 South Clinton Street, Chicago

SAUERMAN

SLACKLINE CABLEWAYS : POWER DRAG SCRAPERS

When writing advertisers, please mention ROCK PRODUCTS

Classified Directory of Advertisers in this Issue of ROCK PRODUCTS

For alphabetical index, see page 160

Pumps (Cement Slurry)
American Manganese Steel Co.
The Dorr Co.
Fuller Co.
Polysius Corporation
F. L. Smidth & Co.
A. R. Wilfley & Sons

Pumps (Centrifugal)
Allis-Chalmers Mfg. Co.
American Manganese Steel Co.
Bethlehem Steel Co.
De Laval Steam Turbine Co.
Hetherington & Berner, Inc.
Novo Engine Co.
Pennsylvania Pump & Compressor Co.
A. R. Wilfley & Sons

Pumps (Pulverized Fuel)
Fuller Lehigh Co.

Pumps (Sand and Gravel)
Allis-Chalmers Mfg. Co.
American Manganese Steel Co.
Hetherington & Berner, Inc.
A. R. Wilfley & Sons

Pumps (Self Measuring for All Liquids)
S. F. Bowser & Co., Inc.

Quarry Development
E. J. Longyear Co.

Railway Equipment
General Electric Co.

Railways (Electric)
General Electric Co.
Woodford Engineering Co.

Rails
Bethlehem Steel Co.
Easton Car & Construction Co.
Hyman-Michaels Co.
Morrison & Risman

Refractories
General Refractories Co.

Regulators (Welding and Compressed Gas)
Oxweld Acetylene Co.
Prest-O-Lite Co.
Prest-O-Weld

Road Machinery
Austin Manufacturing Co.
Bucyrus-Erie Co.
Caterpillar Tractor Co.
Harnischfeger Corp. (Pawling & Harnischfeger)
Koehring Co.
Smith Engineering Works
Universal Road Machinery Co.

Rock Drills (See Drills, Rock)

Rod Mills
Jackson & Church Co.
Traylor Eng. & Mfg. Co.

Rods (Welding)
Oxweld Acetylene Co.
Prest-O-Lite Co.
Prest-O-Weld

Roller Bearings
Hyatt Roller Bearing Co.

Rolls (Magnetic)
Magnetic Mfg. Co.

Roofing Machinery (Cement Asbestos)
Komnick Machy. Co.

Rope (Wire) (See Wire Rope)

Sand Separators
Stephens-Adamson Mfg. Co.

Sand Settling Tanks
Smith Engineering Works
Stephens-Adamson Mfg. Co.
F. M. Welch Eng. Service.

Scrapers (Power Drag)
Austin Mfg. Co.
R. H. Beaumont Co.
L. P. Green
Hayward Co.
Link-Belt Co.
Sauerman Bros.

Screens
Allis-Chalmers Mfg. Co.
American Manganese Steel Co.
Austin Mfg. Co.
Chain Belt Co.
Chicago Perforating Co.
Cleveland Wire Cloth & Mfg. Co.
Cross Engineering Co.
Rubert M. Gay & Co. (Vibrating)
Galland-Henning Mfg. Co.
Gruendler Patent Crusher & Pulverizer Co.
Hardinge Co.
Harrington & King Perforating Co.
Hendrick Mfg. Co.
Industrial Brownhoist Corp.
Jeffrey Mfg. Co.
Kent Mill Co.
Link-Belt Co.
Ludlow-Saylor Wire Co.
Manganese Steel Forge Co.
McLanahan-Stone Mach. Co.
Robins Conveying Belt Co.
John A. Roebling's Sons Co.
Simplicity Engineering Co.
Orville Simpson Co. (Gyrating)
Smith Engineering Works
Stephens-Adamson Mfg. Co.
Sturtevant Mill Co.
W. Toepfer & Sons Co.
Traylor Eng. & Mfg. Co.
W. S. Tyler Co.
Universal Crusher Co.
Universal Vibrating Screen Co.
F. M. Welch Eng. Service

Seal Rings (Rotary Kiln)
Huron Industries, Inc.

Separators, Air (See Air Separators)

Separators (Magnetic)
Magnetic Mfg. Co.

Separators (Slurry)
F. L. Smidth & Co.

Shaft Sinking
E. J. Longyear Co.

Sharpening Machines, Drill (See Drill Sharpening Machines)

Sheaves
Dobbie Foundry & Machine Co.

Shovels (Steam, Gas, Electric, Diesel, Oil)
Browning Crane Co.
Bucyrus-Erie Co.
Byers Machine Co.
Harnischfeger Corp. (Pawling & Harnischfeger)
Hayward Co.
Industrial Brownhoist Corp.
Insley Mfg. Co.
Koehring Co.
Link-Belt Co.
Monighan Machine Co.
Owen Bucket Co.
Thew Shovel Co. (Crawler Tractor)

Silos
Burrell Eng. & Constr. Co.
F. L. Smidth & Co.

Skip Hoists and Skips
R. H. Beaumont Co.
Link-Belt Co.
Stephens-Adamson Mfg. Co.
Vulcan Iron Works
F. M. Welch Eng. Service.

Slings (Wire Rope)
A. Leschen & Sons Rope Co.
John A. Roebling's Sons Co.

Speed Reducers
Cleveland Worm & Gear Co.
De Laval Steam Turbine Co.
Horsburgh & Scott Co.
Huron Industries, Inc.
R. D. Nuttall Co.
Philadelphia Gear Works
Stephens-Adamson Mfg. Co.

Speed Transformers

Spouts, Chutes (See Chutes and Chute Liners)

Spouts (Magnetic)
Magnetic Mfg. Co.

Sprockets and Chain
American Manganese Steel Co.
Chain Belt Co.
Fuller Lehigh Co.
Horsburgh & Scott Co.
Jeffrey Mfg. Co.
Philadelphia Gear Works
S. G. Taylor Chain Co.

Steam Specialties
Penberthy Injector Co.

Steel (Special Alloy)
Alloy Steel & Metals Co.
American Manganese Steel Co.
Bethlehem Steel Co.

Steel Fabrication
Bollinger-Andrews Const. Co.
H. K. Ferguson Co.

Steel Plate Construction
Hendrick Mfg. Co.
Jackson & Church Co.

Steel (Structural)
Bethlehem Steel Co.

Steps (Safety)
Kerlow Steel Flooring Co.

Stokers
Raymond Bros. Impact Pulv. Co.

Stone Grapples—See Grapples (Stone)

Storage Equipment
R. H. Beaumont Co.
S. F. Bowser Co., Inc.
L. P. Green
Sauerman Bros.

Tampers (Power)
Consolidated Concrete Mach. Co.

Tanks
S. F. Bowser & Co., Inc.
The Dorr Co.
Manitowoc Engineering Works
Smith Engineering Works

Thickeners
The Dorr Co.
Hardinge Co.

Tile (Concrete) Machinery
Consolidated Concrete Mach. Co.

Tool Steel
Bethlehem Steel Co.

Tools, Drill (See Drilling Accessories)

Torches
Oxweld Acetylene Co.
Prest-O-Lite Co.
Prest-O-Weld

Track Equipment
Atlas Car & Mfg. Co.
Bethlehem Steel Co.
Easton Car & Construction Co.

Tractors
Caterpillar Tractor Co.

Trailer Cranes (See Cranes)

Tramways (Aerial Wire Rope)
Broderick & Bascom Rope Co.
Interstate Equipment Corp.

Transmission Belting
B. F. Goodrich Rubber Co.
Goodyear Tire & Rubber Co., Inc.

Transmission Machinery
Allis-Chalmers Mfg. Co.
Cleveland Worm & Gear Co.
Huron Industries, Inc.
Hyatt Roller Bearing Co.
Kritzer Co.
Stephens-Adamson Mfg. Co.

Trenchers (Wheel & Ladder Type)
Harnischfeger Corp. (Pawling & Harnischfeger)

Truck Cranes (See Cranes)

Tube Mills (See Mills, Ball, Tube, etc.)

Tube Mill Liners (See Mill Liners)

Tubing (Blasting)
B. F. Goodrich Rubber Co.

Tunnelling Machinery
Bucyrus-Erie Co.
E. J. Longyear Co.

Turbines
De Laval Steam Turbine Co.

Turbo-Generators
De Laval Steam Turbine Co.

Turntables
Easton Car & Construction Co.

Underground Loaders
Bucyrus-Erie Co.
Thew Shovel Co.

Valves
Merco Nordstrom Valve Co. (Lubricated Plug)
Oxweld Acetylene Co.
Prest-O-Lite Co.
Prest-O-Weld

Valves (Pump)
B. F. Goodrich Rubber Co.

Vibrating Screens (See Screens)

Washers (Sand, Gravel and Stone)
Allis-Chalmers Mfg. Co.
The Dorr Co.
McLanahan-Stone Mach. Co.
F. L. Smidth & Co.
Smith Engineering Works
Stephens Adamson Mfg. Co.
Traylor Eng. & Mfg. Co.
F. M. Welch Eng. Service

Weighing Equipment
Merrick Scale Mfg. Co. (Automatic Proportioning)
Schaffer Poidometer Co.

Welding and Cutting Apparatus
General Electric Co.
Oxweld Acetylene Co.
Prest-O-Lite Co.
Prest-O-Weld

Welding Wire
John A. Roebling's Sons Co.

Well Drills (See Drills, Well)

Wheels (Car)
American Manganese Steel Co.
Easton Car & Construction Co.
Fuller Lehigh Co.
Vulcan Iron Works

Winches and Capstans
Dobbie Foundry & Machine Co.
Mundy Sales Corp.
Novo Engine Co.

Wire Cloth
Cleveland Wire Cloth & Mfg. Co.
Ludlow-Saylor Wire Co.
Manganese Steel Forge Co.
John A. Roebling's Sons Co.
W. S. Tyler Co.

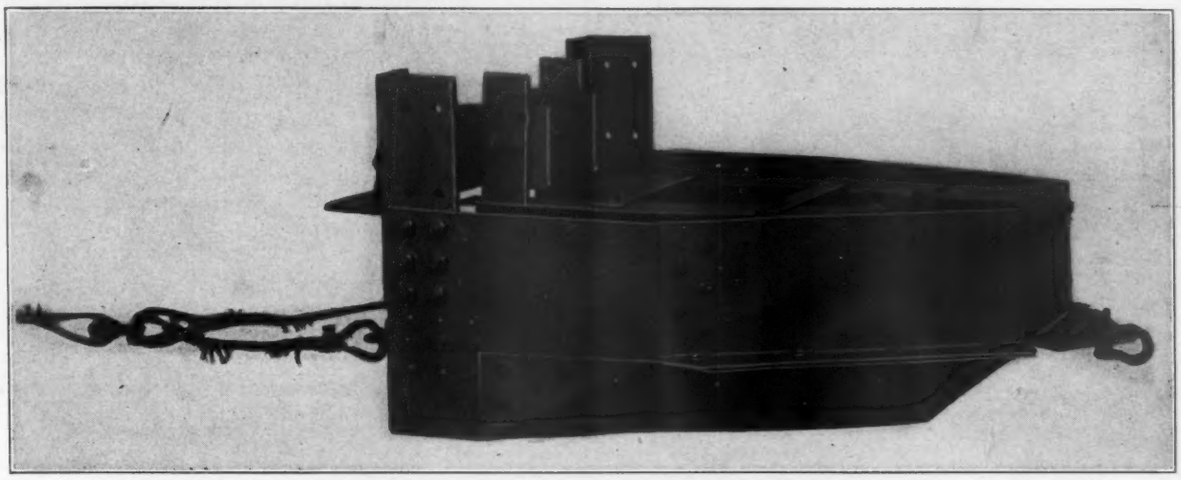
Wire (Manganese Steel)
Manganese Steel Forge Co.

Wire Rope
Broderick & Bascom Rope Co.
L. P. Green
A. Leschen & Sons Rope Co.
John A. Roebling's Sons Co.

Wire Rope Fittings
Broderick & Bascom Rope Co.
A. Leschen & Sons Rope Co.
John A. Roebling's Sons Co.

Worm Gears (See Gears)

The Green Power Scraper



Patented and Patents Pending

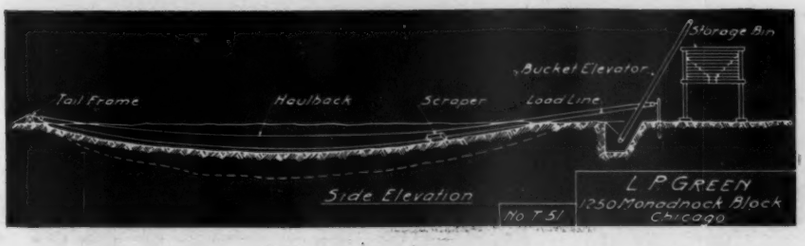
The Scraper Patent Litigation Brought by Le Clair Against Green was Ordered Dismissed by the United States Court of Appeals in a Decision Rendered January 10, 1928.

Right now we are not going to give details about the economy, efficiency, adaptability, etc., of the Green Scraper—

Compare the structure of the Green Scraper with other scrapers offered and you can readily see that if any scraper will handle your job, a Green Scraper will do it.

The Main Information You Require is that the Green Scraper is Back in the Ring with Vengeance. Be Sure to Get Green's Prices Before Buying Elsewhere.

GREEN SCRAPER installation excavating hillside deposit delivering to belt conveyor



Green scraper installation excavating level deposit delivering to bucket elevator

To those that may not know what the name **"Green"** stands for when used in connection with **"power scraper"**; beginning in 1916 **Green** has placed on the market 5 different scrapers all but one having been designed by **Green** and built under his patents.

Therefore the **Green Scraper** is not just another **scraper** but a **progressive development** of **scraper experience.**

L. P. GREEN

501 Monadnock Block
Chicago Illinois

Beaumont
Cable Drag Scraper
SIMPLE—ECONOMICAL

The Cable Drag Scraper is offered as the most economical solution of such jobs as stripping overburden, working bank deposits of sand, gravel, clay, etc. For stock piling it is without an equal, covering the entire area without having to make room for tracks. Thus every square foot of the storage area can be put to profitable use.

The Beaumont Scraper is designed for 100% shear cut and is of very rigid construction. Teeth are reversible and are of manganese steel. Cutting blade separate from main body of Scraper so as to be easily renewable.

Built in sizes from 1/3 to 4 yards, for either electric, gasoline, steam, or belted operation.

Complete specifications and prices will be furnished on request

Write for Catalog

R. H. BEAUMONT CO.

313 Arch Street, Philadelphia, Pa.
1544-C Straus Building, Chicago, Ill.

Long Wearing Gears

THE helical gears used in Nuttall speed reducers have better wearing characteristics than any other type of gearing.

In the engagement of gear teeth there are two actions, rolling and sliding, most wear taking place in the latter. The helical gear tooth form gives 50 per cent more rolling action than is possible with 14½ degree involute spurs, and wear is eliminated to that extent.

Helical gear teeth have more metal than those of 14½ degree spurs at the pitch line where wear takes place, and, therefore, have greater wear life.

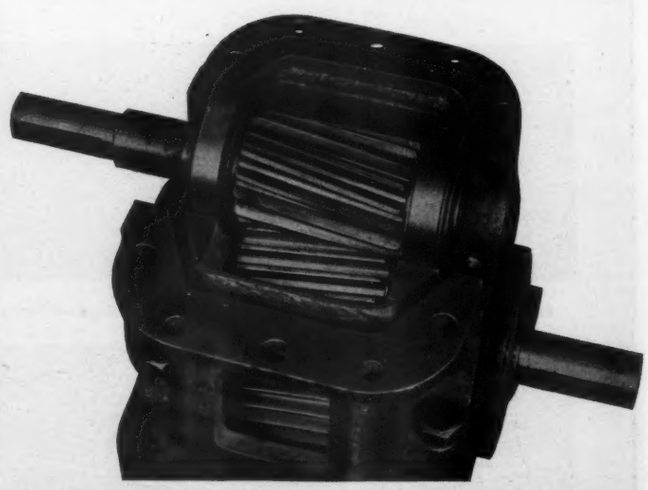
Helical gears, even as they wear, preserve their correct involute tooth form and do not "ridge" at the pitch line as is customary with spurs. As a result even worn helicals operate quietly.

Gears in Nuttall Speed Reducers are hobbed from forged steel blanks and are heat treated and hardened to give them greater strength and wear resistance.

Send for our bulletin No. 59

R. D. NUTTALL CO., Pittsburgh, Pa.

Philadelphia Chicago Cincinnati Los Angeles
Dallas Houston Tulsa
Lyman Tube & Supply Co., Montreal and Toronto, Canada

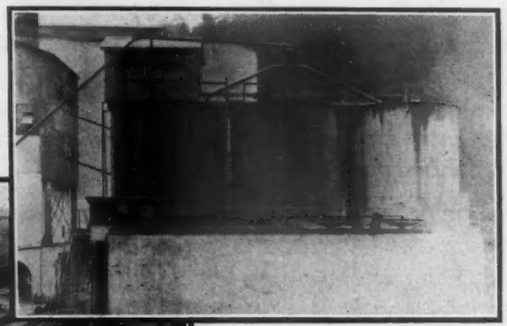


Nuttall

AGITATORS for CEMENT SLURRY

Mechanical and Air Agitation

CORRECTING BASINS



MIX BASINS

STORAGE BASINS

F. L. SMIDTH & CO.

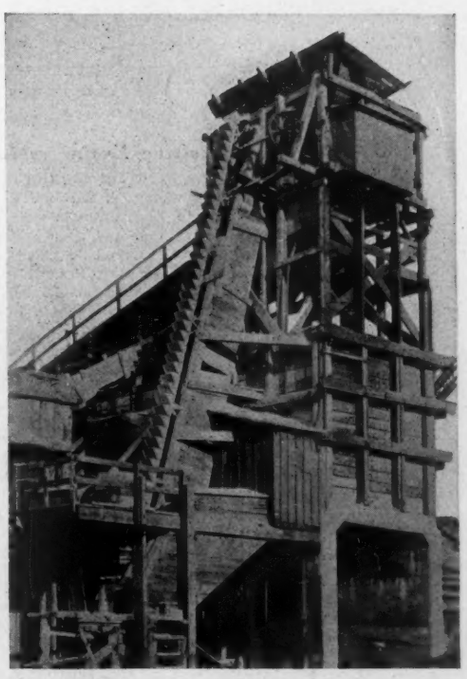
(Inc. 1895)

ENGINEERS

50 Church Street — DESIGNERS AND EQUIPPERS OF CEMENT MAKING FACTORIES — New York City

Factory, Foundry and Laboratory—Elizabeth, N. J.

SAND and GRAVEL PLANTS



Webster plants for the washing of sand and gravel are designed along simple and substantial lines, avoiding the introduction of any of the impractical elaborations of conveying and handling equipment which experience has proved unreliable and undesirable. Every plant is designed especially to meet the requirements of the material it is to handle and the conditions under which it is to operate.

Webster Engineers Are at Your Service

We Make a Complete Line of

MATERIAL HANDLING EQUIPMENT

for Sand, Gravel, Cement, Stone, Gypsum, Etc.

THE WEBSTER MFG. COMPANY

1856 N. Kostner Ave., CHICAGO

WEBSTER — *Write to*

It's a Giant for Work

IN "stature" the Improved Type "C" Universal Vibrating Screen is not above the average. Nor is it below the average. It's just a standard size screen. But you can't judge the Type "C" entirely by its dimensions. Though only average in "stature"—when it comes to turning out the work it is a GIANT.

Big capacity is one of the outstanding characteristics of the Universal Type "C." The vibrating mechanism has been developed to the point where it imparts to the screen frame and screen cloth a vibratory motion that produces the highest possible mesh efficiency, large capacity and accurate separations.

Simple in Design—Economical to Operate
The screen cloth can be changed in five minutes time.

Improved Type C

UNIVERSAL VIBRATING SCREEN CO.
RACINE - - WISCONSIN

IF YOU CONTEMPLATE

Building a new sand and gravel plant or rebuilding the old one

Why not benefit by our practical experience?

Keystone Gravel Co., Dayton, Ohio. Cap. 60 cars per day. Storage cap. 2,100 tons. Designed by us in 1921.

Our designs are the results of actual plant operations, obtained under all conditions.

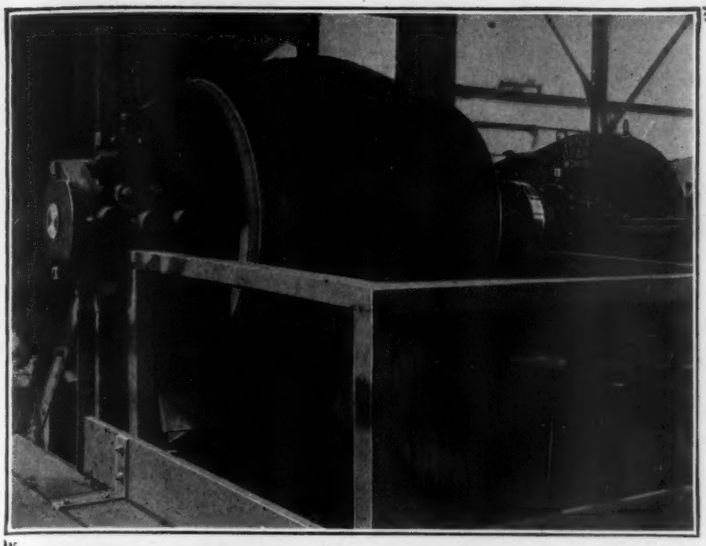
We have helped solve the problems of the above concerns—may we help you?

Chief Engineer of
The Greenville Gravel Corporation, Greenville, Ohio.

Consulting Engineers for
Allegany Sand and Gravel Co., Olean, N. Y.
Atlas S. & G. Company, Hartford, Conn.
Benzieco Gravel Company, Beulah, Mich.
Boston S. & G. Company, Boston, Mass.
Crawford Sand and Gravel Co., Jamestown, Pa.
Crescent Gravel Company, Hersey, Mich.
Dayton Gravel and Sand Co., Dayton, Ohio.
Fountain Sand and Gravel Co., Pueblo, Colo.
Granite S. & G. Company, Indianapolis, Ind.
Hagersville Quarries, Ltd., St. Thomas, Ont.
Hersey Gravel Company, Hersey, Mich.
Industrial Sand and Gravel Co., Lawton, Okla.
Interstate S. & G. Company, Covington, Ind.
J. N. Dugan S. & G. Co., Cincinnati, Ohio.
Jno. E. Russell Co., Ltd., Toronto, Ont.
Johnson-Hudson Gravel Co., Chillicothe, Mo.
Keystone Gravel Company, Dayton, Ohio.
Lehigh Sand and Stone Co., Scranton, Pa.
Limestone Lumber Co., Maysville, Ky.
Mercer Sand Company, Meadville, Pa.
Meriwether S. & G. Company, Shreveport, La.
Merom Gravel Company, Merom, Ind.
Midland Gravel Company, Milbrook, Mich.
Ray Sand and Gravel Company, Oxford, Mich.
Roquemore Gravel Co., Montgomery, Ala.
T. J. Hall and Company, Cincinnati, Ohio.
Wilson Sand and Supply Co., Huntington, W. Va.
Wolf Creek Gravel Company, Dayton, Ohio.
And Others

The F. M. Welch Engineering Service

Consulting Engineers **Greenville, Ohio**



Adverse Conditions prove the Real Worth of Philadelphia SPEED REDUCING UNITS

—because they have a liberal factor of safety in all parts. Recommendation from our Engineers assures you that they have taken into account the various factors of Horsepower, Speeds, Continuous or Intermittent Operation, Steady or Shock Load—all judged carefully and impartially, that your Philadelphia Reduction Unit, whether it be Worm, Spur or Herringbone Type, may give you a long period of uninterrupted and low cost-per-year service.

Philadelphia Speed Reducers have nearly a Half Century's Gear Making Experience built into them and are made in the newest and most modern Gear Plant in America. They are the ideal drive for Rotary Kilns, Screw Conveyors, Agitators, Ball Mill Feeders, Hydrators, Rotary Dryers, Bag Cleaners, Slurry Tanks, Grizzlies, Crushers, Feeder Loaders, Mechanical Stokers, Elevators, Screens, etc.

Main Office and Plant Erie Ave. and G St. Phila., Pa.

PHILADELPHIA GEAR WORKS

Manufacturers of Industrial Gears and Speed Reducing Units

PHILADELPHIA, PENNA.

Branch Sales and Engineering Office: 12 E. 41st St., New York

Cylpebs

(Patented) (Trademark Reg.)

Cylpebs are cylindrical metallic grinding bodies for Tubemills, made of a special mixture of white iron under laboratory control. They possess great durability, and have considerably greater grinding surface than have grinding balls. Being cylindrical in shape, they can strike along an entire line, where the spherical grinding bodies strike at only one point.

Shown at left (inset) is a Cylpeb of the 1" x 1¼" size, photographed actual size. Cylpebs are also made in ⅝" x 1" size. Shipment from stock. Prices and users' reports on request.

F. L. SMIDTH & CO.

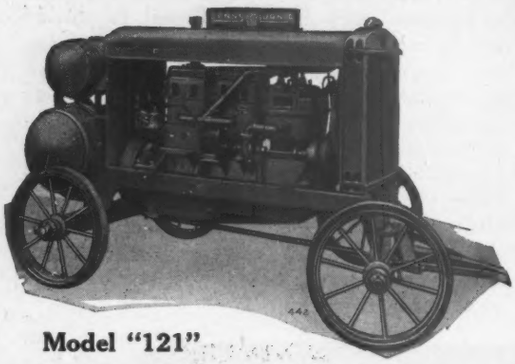
(Inc. 1895)

ENGINEERS

50 Church Street — DESIGNERS AND EQUIPPERS OF CEMENT MAKING FACTORIES — New York City

Factory, Foundry and Laboratory—Elizabeth, N. J.

PENNSYLVANIA



Model "121"

Pennsy-Portable Air Compressor

In this new PENNSYLVANIA Portable, the compressor and engine are combined in one unit—the four power cylinders and two air compressor cylinders being mounted on a common crank case containing the six-throw crank shaft.

This unit-type construction provides a compact, rigid machine, without clutch gear or coupling—the power being applied to the air compressor through the single crank shaft.

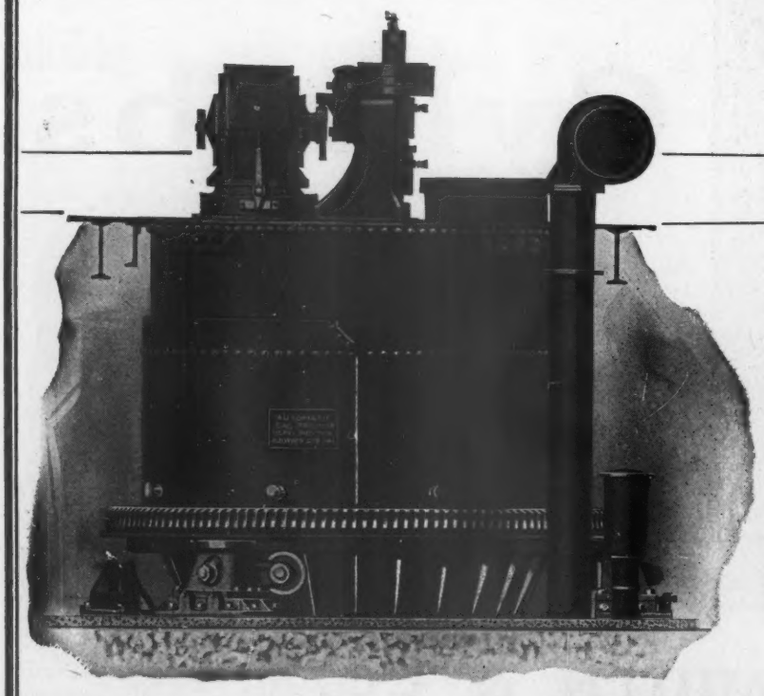
Bulletin No. 133 gives details

"None Better Built"

PENNSYLVANIA PUMP & COMPRESSOR COMPANY

Main Office and Works: Easton, Pa.

Sales Representatives in Principal Cities



THE NEW WOOD GAS PRODUCER

Used in Leading Lime Plants

The new Wood Heavy Duty Producer is the result of twelve years' experience in the design, manufacture and operation of Automatic Gas Producers. Every detail of the machine is built for

Heavy Duty and Continuous Service

and for this reason the cost of upkeep is considerably less than with any other Mechanical Gas Producer.

Our Catalog Will Interest You. Write For It.

HYDRAULIC MACHINERY AND OPERATING VALVES

R. D. WOOD & CO.

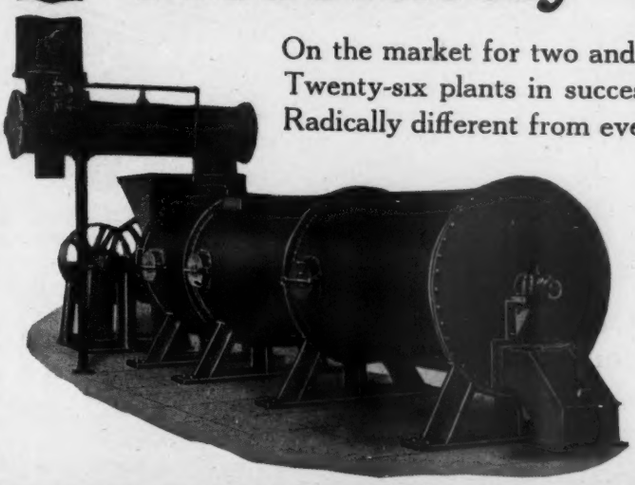
ESTABLISHED 1803

PHILADELPHIA, PA.

CAST IRON PIPE, HYDRANTS AND VALVES

SCHULTHESS HYDRATOR

Absolutely Dustless!



On the market for two and one-half years.
Twenty-six plants in successful operation.
Radically different from every other hydrator.

No preliminary crushing of lime before being introduced to hydrator.

Absolute freedom from dust.

Built in six sizes.

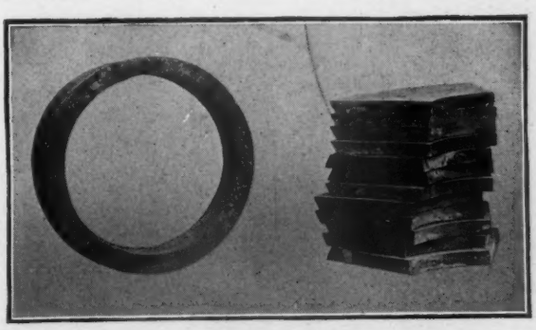
Write us for further information and prices

McGANN MANUFACTURING COMPANY, INC.
Engineers and Manufacturers
CHICAGO YORK, PA. NEW YORK

ADAMITE
(PATENTED)

Muller Tires and Pan Bottom Plates

ADAMITE, the wear resisting metal, is increasing production through fewer mill shutdowns for changes of worn-out tires and bottom plates. A corresponding increase in production is the natural result. In addition the extra life of Adamite means an actual saving in the annual expense of upkeep. A trial order will bring these facts directly home to you.



ADAMITE was developed for the express purpose of resisting wear.

MACKINTOSH-HEMPHILL COMPANY
ESTABLISHED 1803 AT PITTSBURGH

Pittsburgh Iron & Steel Foundry
A. Garrison Foundry
PIONEERS
ENGINEERS
BUILDERS
Woodard Machine Company
Fort Pitt Foundry

"Splendid Service"
Through 12 Years of Shay Operation

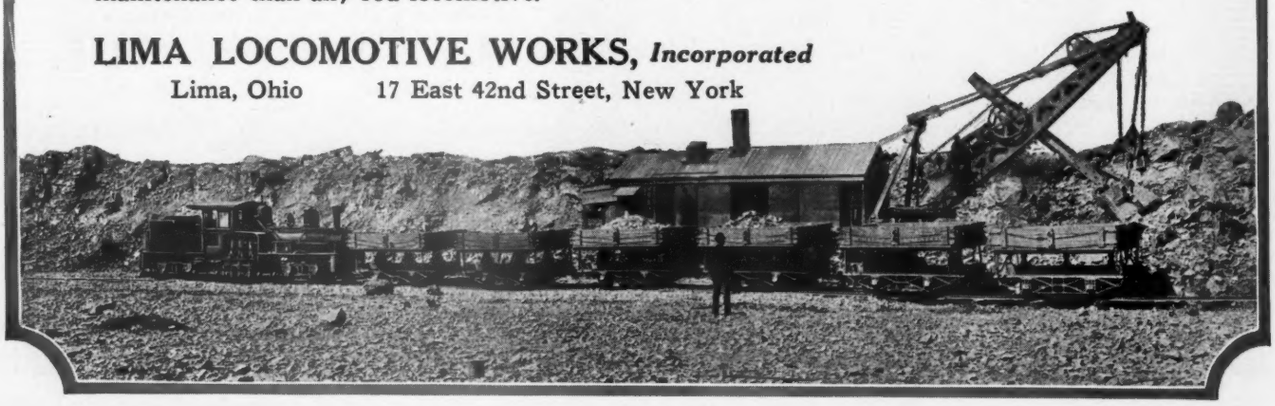
"IN use continuously for over twelve years, doing work under very hard conditions, on many 35 degree curves and grades as steep as 12 per cent, Shays have given us splendid service," writes the President of a certain company.

Perfect adaptability to any conditions—no matter how severe—has long been a characteristic of the Shay.

On rough, crooked track, Shays are right at home. They climb hills that would have to be cut through for the operation of other locomotives. They give more service with less maintenance than any rod locomotive.

Write for a Shay catalog

LIMA LOCOMOTIVE WORKS, *Incorporated*
Lima, Ohio 17 East 42nd Street, New York

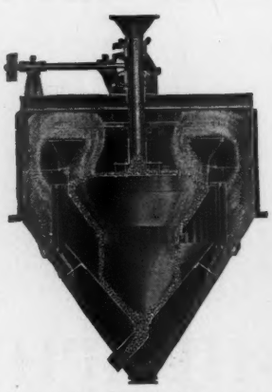


Mexecon Mill

for economical pulverizing

American Filter Air Separator

for fine separating

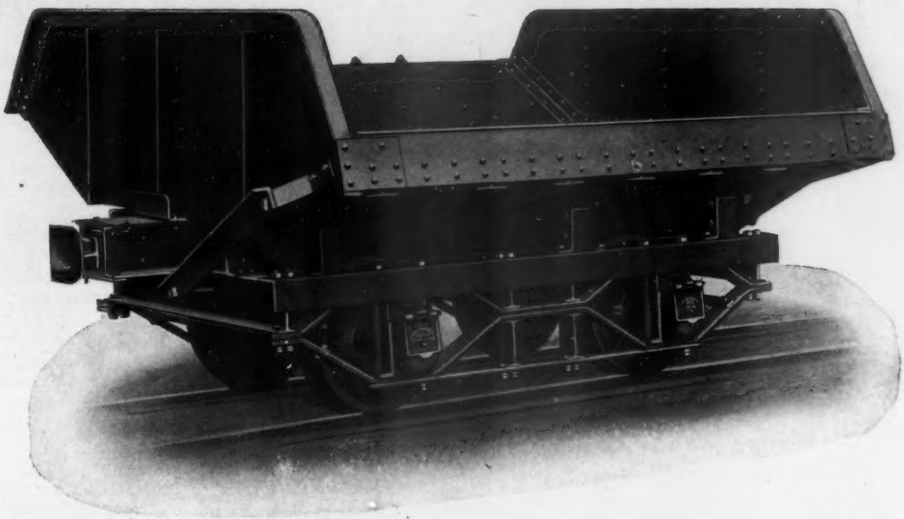


Perfectecon Screen

for coarse screening

KENT MILL COMPANY
10 Rapelyea Street **Brooklyn, N. Y.**

BUILT STRONGER—*then* RE-INFORCED



THAT, in brief, tells the story of CONTINENTAL CARS. It explains their great ruggedness, long life, low maintenance, and all-around utility—characteristics which have combined to make them the first choice of a large number of operators who use car haulage methods.

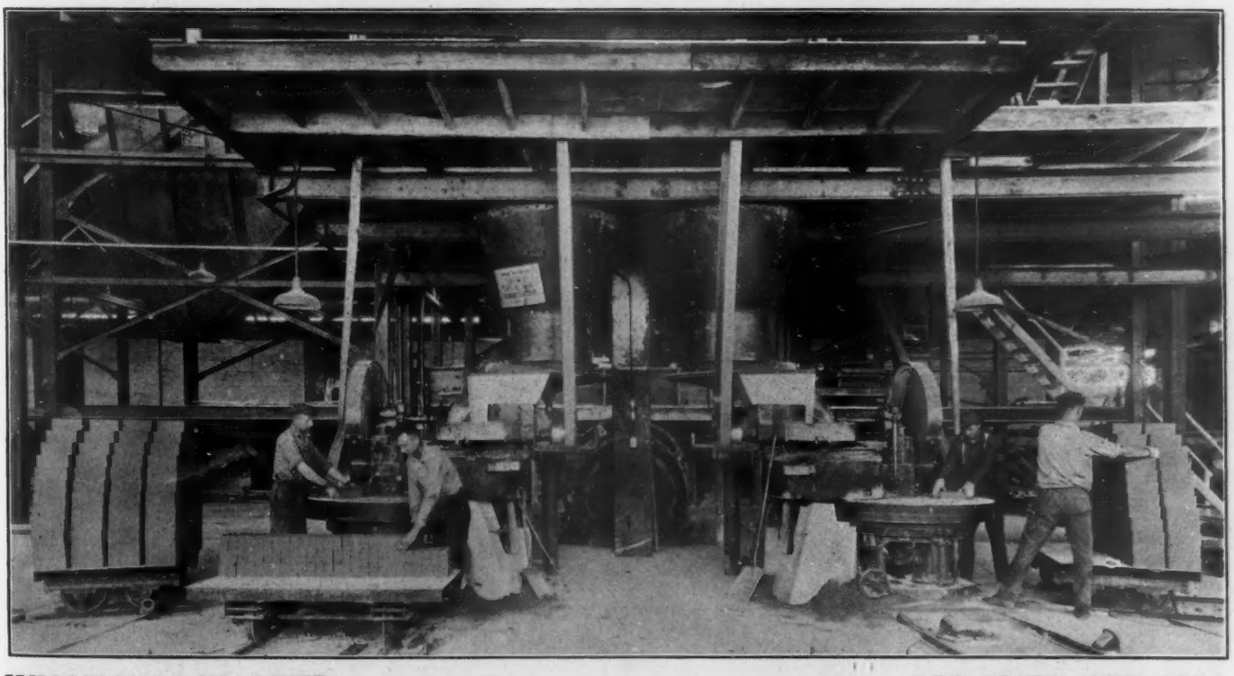
Every part and member of CONTINENTAL CARS are made of the very best materials available for each purpose—with adequate bracing and reinforcing at those points subject to the most wear or strain. The trucks are ***all-steel,*** and of such strength as to withstand without strain twice the load they are intended to carry.

The wheels are made according to M. C. B. specifications—of larger size than ordinary—to permit easier moving and the handling of more cars in a train.

Write for complete catalog showing all types of CONTINENTAL CARS

KENTUCKY WAGON MANUFACTURING COMPANY, LOUISVILLE, KENTUCKY

THE ROCHESTER SAND AND BRICK CO.



WHAT WAS WANTED:

Large Production
Low Labor Cost
Good Product
Dependable Machinery

JACKSON & CHURCH
SAND LIME BRICK MACHINERY
company
SAGINAW, MICH. U. S. A.

DID THEY GET IT?

YES.

Why Spend Money on Experiments?

The *GRUENDLER* heavy duty all steel hammer mills, with reductions of 48 to 1, 36 to 1, 24 to 1, and 12 to 1, are of the modern type and are equipped with heavy duty roller bearings, continuous oil feed and tramp iron catcher.

The illustration shows a *GRUENDLER* 50x52 inch Cement Crusher.

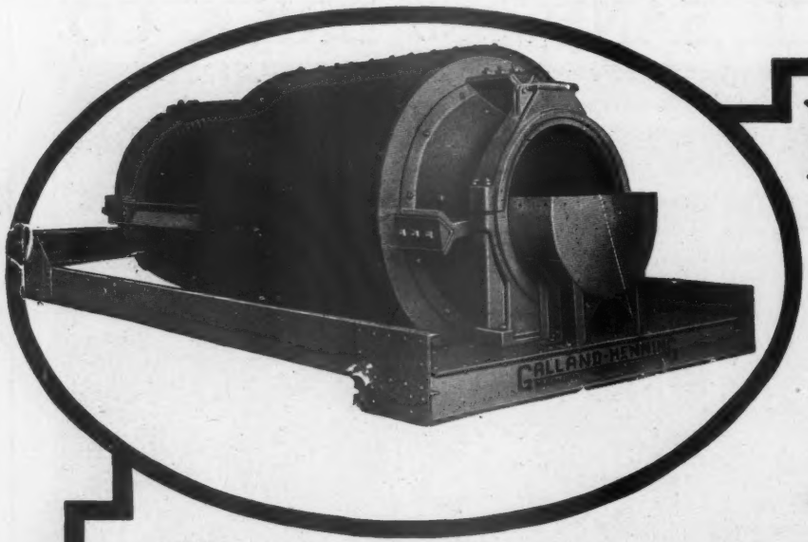
WHY spend money experimenting to find the best crusher for your work, when we offer the result of over 43 years application to the development of the *GRUENDLER* Swing Hammer Crusher.

This crusher has an enviable national reputation for efficiency of performance and exceptionally low operating cost. Its life is several times that of an ordinary crusher—shutdowns for repairs are done away with, when a *GRUENDLER* Swing Hammer Crusher is on the job.

The *GRUENDLER* is ideal for use as a preliminary crusher for all materials, for reduction to sizes suitable for roller mills, tube or ball mills or centrifugal beater mills. And it is extensively used in cement plants, quarries and all other industries requiring reduction units.

Gruendler Patent Crusher & Pulverizer Company
St. Louis, Mo.

GRUENDLER
CRUSHERS • PULVERIZERS • GRINDERS



Rollerless Rotary - *Simple - Accessible Economical*

IMPORTANT points, you'll agree, in any consideration of the relative merits of screening equipment. Characteristics that are absolutely essential to 100 per cent screen performance. The Galland-Henning Rollerless Rotary Screen is a unit of unusual simplicity. The number of moving parts has been greatly reduced by the elimination of the usual rollers, riding rings and subsequent bearings. All parts are readily accessible, so that those requiring replacement after long service can be easily reached without necessity of dismantling the entire screen. That the Rollerless Rotary is ECONOMICAL to operate and maintain is evidenced by every installation in stone and gravel plants.

Complete specification and prices furnished on request

GALLAND-HENNING
MANUFACTURING COMPANY
MILWAUKEE — U. S. A.

A *High* Temperature Cement
That is Highly Resistant to Corrosive Attack

GREFCO is a chrome base high temperature cement; hence it is neutral in character. It is free of sodium silicate and other active fluxes, and is highly resistant to corrosive attack.

Since its introduction two years ago, GREFCO has been adapted by a number of well-known cement plants for kiln hood work, laying up nose ring blocks, dryer furnaces, clinker chutes from kilns to coolers, boiler furnaces and other plant applications.

Send for a sample of GREFCO. Try it. Note its high refractoriness and other advantages.

GENERAL REFRACTORIES COMPANY

106 South 16th Street, Philadelphia, Pa.

District Offices—Buffalo, Chicago, Cleveland, Detroit, Indianapolis, New York, Pasadena, Pittsburgh
Canadian Representative—Webster & Sons, Ltd., Montreal, Canada

The De Laval Flexible Coupling
Defies Dirt!
THERE are no rubbing metallic surfaces to grind or wear. No lubrication is required and the coupling does not become gummed or stuck. The rubber is securely held on flanged spools and cannot work out. The photo shows De Laval couplings in drive from motor, through De Laval worm gear to cement elevator.
Ask for catalog 1054.
De Laval Steam Turbine Co.,
Trenton, N.J.
2505

It's the way they Perform that make Dixie Hammermills Popular!

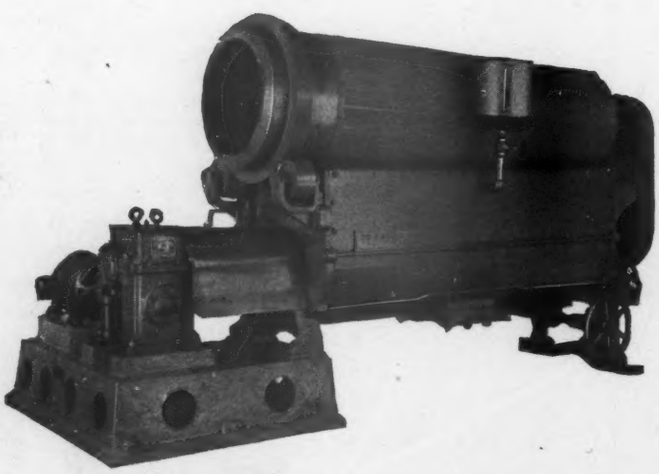
"THE Dixie Hammermills with the moving breaker plate have given excellent results."

This is the kind of a report we received from one of the largest cement mills in the country that have installed Dixie Hammermills, with Non-Clog Movable Breaker Plates.

DIXIE MACHINERY MFG. CO.

4209 Goodfellow Avenue **St. Louis, Missouri**

DRIVE IT WITH GEARS



The makers of this sand mixer found it to their advantage to use Horsburgh & Scott worm gear speed reducer drives. Delivering a smooth flow of power year after year in sand and grit requires a sturdy, well made reducer. It is in drives where the going is hardest that the real built-in quality of Horsburgh & Scott reducers is apparent.

Send for bulletins describing these reducers in detail

The Horsburgh & Scott Co.

5000 Hamilton Ave. ***"Gear Makers Since '89"*** **Cleveland, U. S. A.**

Gears for Every Industrial Purpose—Worm—Bevel—Herringbone—Spur—Spiral—Hardened Heat Treated Gears Non-Metallic Gears and Pinions

Simplicity Vibrators

Simplicity "UTILITY" Single Vibrator

2'x6' Screen Surface—Single, Double and Triple Deck
3'x6' Screen Surface—Single, Double and Triple Deck

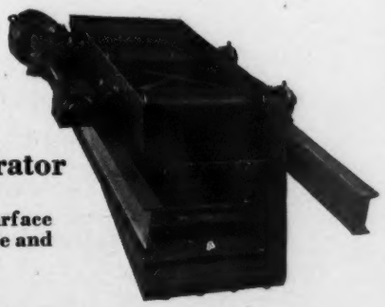
FOR screening either wet, damp, or dry materials, the Simplicity line of vibrators provides a choice of screen equipment that gives to the buyer positive assurance of large capacity and close grading. The correctness of Simplicity design has been proved many times over in dozens of plants.

For every type of plant operation or pit condition, there is a Simplicity Screen—either the "SUPER" or "UTILITY"—exactly fitted to deliver the maximum in screen efficiency and long service.

The wide experience of our engineers in the solution of screening problems is at your service.

Simplicity "Super" Double Vibrator

3'x6' Screen Surface —Single, Double and Triple Deck.



Write for literature

SIMPLICITY ENGINEERING CO.
DURAND, MICHIGAN

BOWSER

The 5 big reasons for plant garages

Plant garages pay, when properly equipped. Inefficient and inadequate equipment wastes men's time and slows down service to executives, as well as for trucks and busses. Bowser averts these losses and makes plant garages function economically and efficiently—and will be able to get things just right for your plant garage, too.

These are the principal advantages of an efficient plant garage:

1. Quantity prices on gasoline—gasoline contracts for plant garages are much sought by the principal gasoline marketers.
2. Quantity prices on oils and greases—on the very brands that you've come by experience to believe are best for your requirements.
3. The advantage of getting absolutely dependable and known gasolines and oils, in the original packages.
4. More consistent motor operation—fewer repair bills.
5. Time saved for executives—your garage men do the garaging and your executives aren't distracted by anxiety about their care. The taxi company says: "It's cabs on the street that make us money"—and your version is: "It's executives at their desks that earn us the dividends!"

Depend on Bowser's long experience to steer you straight as to plant garage layout and equipment. For specific details, address Dept. 75.

S. F. BOWSER & COMPANY, Inc.
LUBRICATION ENGINEERS AND MANUFACTURERS
FORT WAYNE, INDIANA, U.S.A.

LUBRICATORS-OIL FILTERS-OILING SYSTEMS-ACCESSORIES
OIL STORAGE AND DISTRIBUTION SYSTEMS

Power Requirements are LOW ~ ~ with the *Improved* HERCULES

EVERY cement manufacturer is confronted with the necessity of finer grinding—naturally he wants to secure that result with the smallest amount of power per barrel.

TWO STAGE REDUCTION IS THE ANSWER AND BRADLEY HERCULES MILLS FOLLOWED BY TUBE MILLS IS THE SOLUTION.

Investigate the situation and find out what plants have recently changed and are now changing from single stage to two stage grinding and installing BRADLEY HERCULES MILLS ahead of their compartment mills, which have been converted into plain Tube Mills.

Let us tell you more about the adaptation of the Bradley Hercules to your own problems.

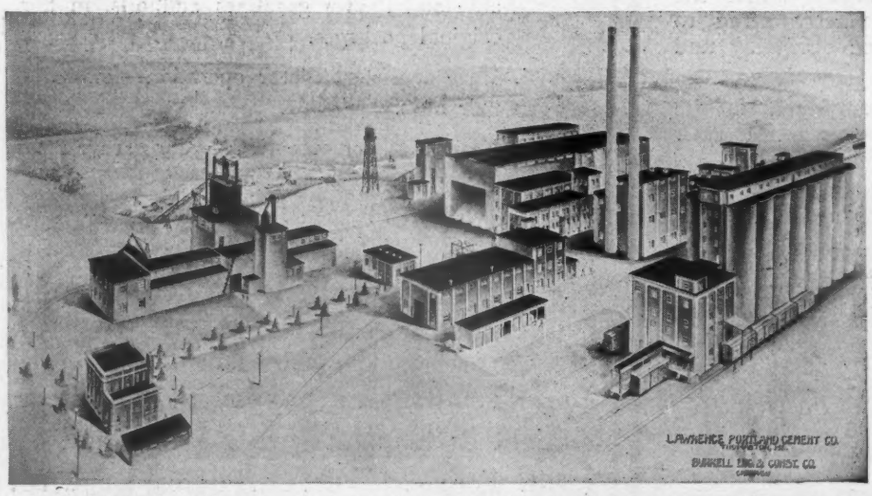
For grinding asphalt filler, agricultural limestone, coal, gypsum and all other non-metallic minerals, investigate the — GRIFFIN MILL, BRADLEY THREE ROLL MILL and BRADLEY PNEUMATIC MILL—all of which are widely used for these purposes.

BRADLEY PULVERIZER COMPANY

Boston **London** **Works: Allentown, Pa.**

BURRELL ENGINEERING and CONSTRUCTION COMPANY

513 JACKSON BLVD., CHICAGO



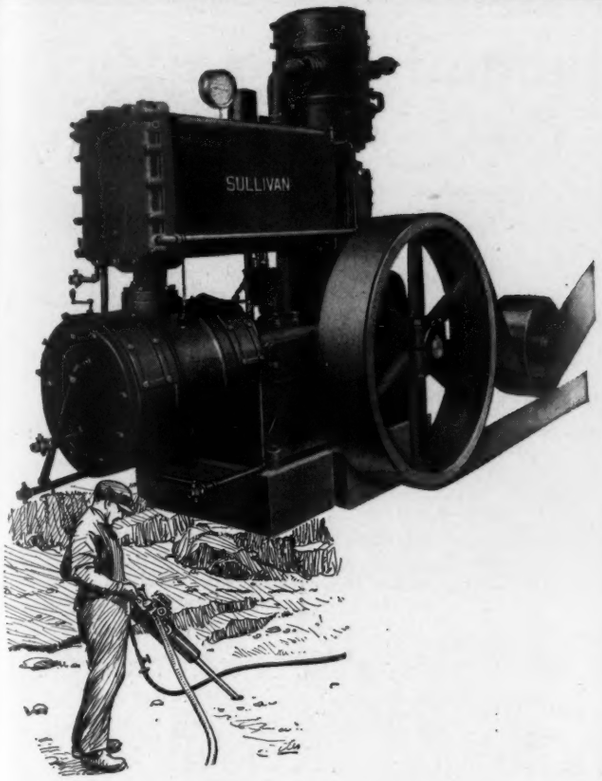
Designers and Builders of

Cement Plants, Stone Crushing Plants, Lime and Gypsum Plants, and Associated Buildings

Our artist's conception of the plant under construction for Lawrence Portland Cement Company, Thomaston, Maine, noteworthy because plant is practically concrete throughout

A PARTIAL LIST OF OUR CLIENTS

Albert Mfg. Co.
Atlantic Gypsum Co.
Blue Mountain Stone Co.
Colorado Portland Cement Co.
Coplay Cement Mfg. Co.
Great Lakes Portland Cement Co.
Hoosac Valley Lime Co.
Huron Portland Cement Co.
Indiana Portland Cement Co.
International Cement Co.
Lawrence Portland Cement Co.
Lehigh Portland Cement Co.
Louisville Portland Cement Co.
Louisiana Portland Cement Co.
Michigan Alkali Co.
Nazareth Cement Co.
New York Trap Rock Co.
Newaygo Portland Cement Co.
Petoskey Portland Cement Co.
Sandusky Cement Co.
Southern Cement Co.
Tomkins Cove Stone Co.
United States Portland Cement Co.
United States Gypsum Co.
Utica Hydraulic Cement Co.
Volunteer Portland Cement Co.
Wellston Iron Furnace Co.



"Angle Compound Hasn't missed a day in 7 years"

Seven years ago the Kittanning Limestone Company, of Kittanning, Pa., installed a Sullivan Angle Compound Air Compressor. Today, after furnishing air to drill more than 160,000 tons of stone, the compressor is running like new and not one day has been lost at the quarry for want of air.

The Kittanning Limestone Co. says:

> "Our machine operates as smoothly today as the day we bought it, and its perfect balance and freedom from vibration justify the Angle Compound design.
>
> "Our repairs have been very few; the bearings have been taken up but once since we started, and the economy in current effected by the unloaders, together with the little attention required, make the Angle Compound a very economical machine to operate."

Such dependability is characteristic of Angle Compound Compressors. The catalog will tell you why.

Write for Catalog 2483-A

SULLIVAN TRADE MARK
MACHINERY COMPANY
82 East Adams Street, Chicago

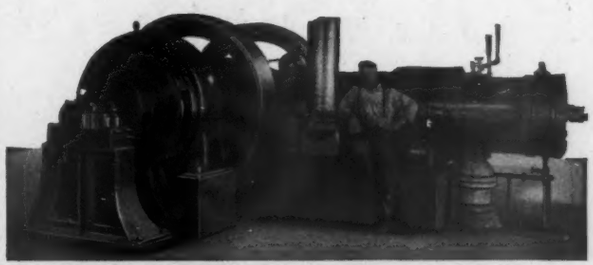
PRIMM OIL ENGINES

STEADY—Primm, Low Pressure, Airless Injection, Diesel Engines are of the two cycle type—and thus deliver a steady flow of power at all times and for long, continuous runs.

ECONOMICAL—Primm Engines are economical on fuel, which is cheap and easily handled. Maintenance costs are remarkably low because of the heavy duty construction—and simplicity saves labor costs.

DEPENDABLE—Strong, rigid construction insures dependable operation at all times with a minimum of shutdowns for adjustment or repair.

EASY TO OPERATE—The care of the engine is by one man for part time only and he need not be an engineer.



Low Pressure
Airless Injection
Diesel Engines

the POWER MANUFACTURING CO.
705 Cheney Avenue, MARION, OHIO
"Oil Engine Builders for a Quarter Century"

Roebling

Blue Center Steel Wire Rope

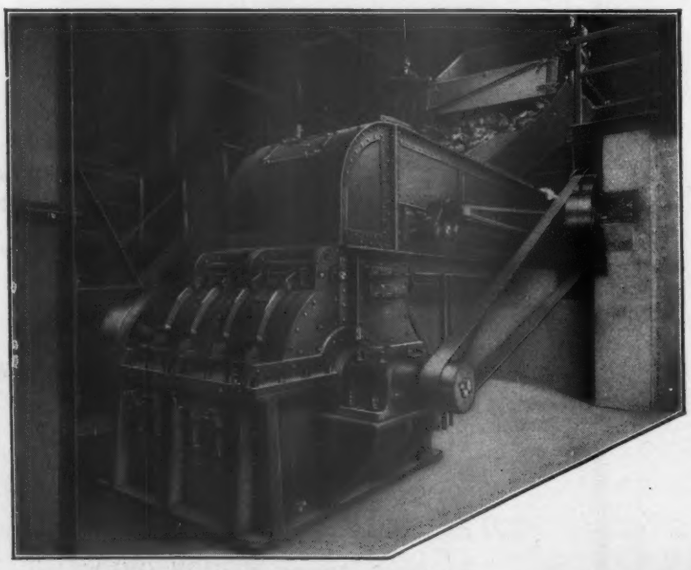
Is especially manufactured for severe service. It is exceptionally tough and will withstand sudden stresses and the grinding and scraping of rough usage.

Made of a superior grade of steel produced in our own furnaces.

DURABLE, DEPENDABLE, ECONOMICAL

John A. Roebling's Sons Company Trenton, New Jersey

POLYSIUS SOLO CRUSHER



Built in Four Different Sizes

400 Tons per hour
200 of Hard Cement
100 Rock up to 30″x
50 30″x40″.

We'll be glad to send additional data and catalogues describing Polysius Cement Mill Equipment.

POLYSIUS CORPORATION

Builders of Polysius Solo Mills and Kilns

BETHLEHEM TRUST BLDG. **BETHLEHEM, PA.**

Putting Idle Capital to Work

THERE'S a way to do it—and not a difficult or expensive way either. As a matter of fact it is already being done in a large number of plants where the Komnick Process Sand-Lime Brick Machinery has been installed.

In those plants there's no such thing as capital being tied up for indefinite periods in surplus stocks of sand or lime. Instead, it is kept working constantly and PROFITABLY.

Let us give you all the details

KOMNICK MACHINERY COMPANY, Inc.
Lafayette Building, Detroit Michigan

Our various types of brick plants are designed for the production of 2500 brick per hour up. Any capacity for any plant.

NORTHERN
Grab Bucket CRANES

DESIGNED FOR
Rock Products INDUSTRIES

The speed, economy and flexibility in handling a Northern bucket crane will appeal to the Rock Products Industry.

Ask us particularly about the type of suspension we use to reduce swinging of bucket, —our dual method of control increasing the amount of material handled by 33 1/3%—and other distinctive features.

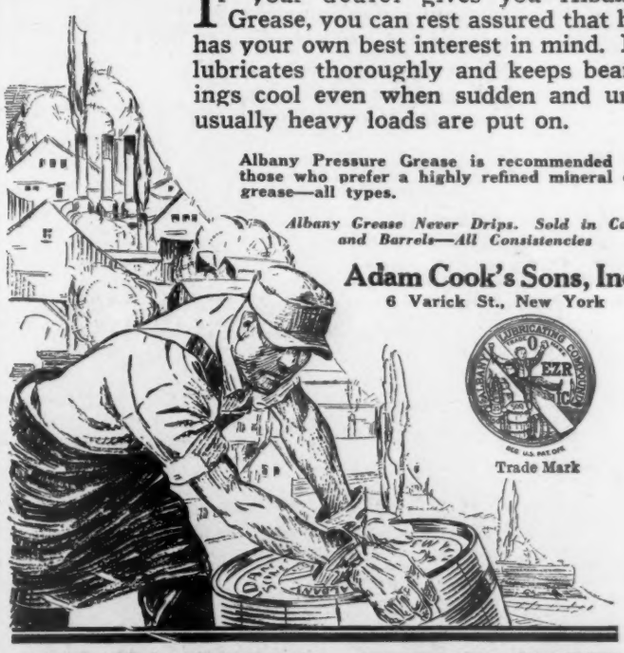
Send for our Bulletin No. 500

NORTHERN ENGINEERING WORKS
DETROIT MICH. U.S.A.

2607 Atwater St.
Branch offices in all of the principal cities

STAFF

Trust Your Dealer



IF your dealer gives you Albany Grease, you can rest assured that he has your own best interest in mind. It lubricates thoroughly and keeps bearings cool even when sudden and unusually heavy loads are put on.

Albany Pressure Grease is recommended to those who prefer a highly refined mineral oil grease—all types.

Albany Grease Never Drips. Sold in Cans and Barrels—All Consistencies

Adam Cook's Sons, Inc.
6 Varick St., New York

Trade Mark

ALBANY GREASE

From Maine to California, from Canada to the Argentine, in Japan, England and Continental Europe

GAYCO DRY CENTRIFUGAL SEPARATORS

are giving wonderfully satisfactory results

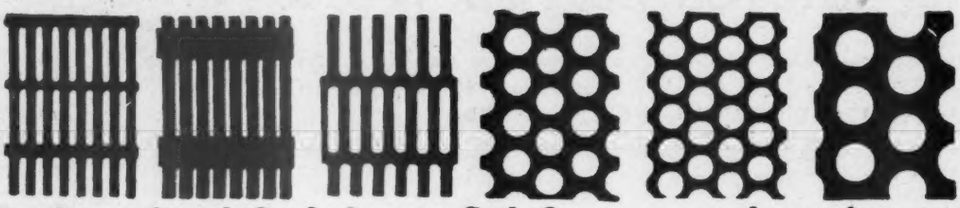
Repeat orders tell the story — numerous customers use from two to twenty GAYCO SEPARATORS sizing dry ground materials.

Any fineness from 80 mesh to 325 mesh. Six sizes—30 inches to 14 feet in diameter.

Rubert M. Gay Company, Inc. 114 Liberty St. New York, N. Y.

PERFORATED METAL SCREENS

All sizes and shapes of Holes



Everything in Perforated Metal

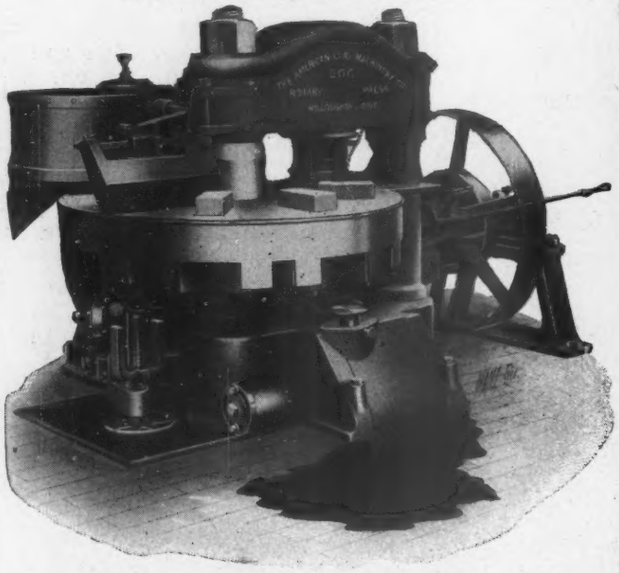
For Stone, Gravel, Sand, Cement, Coal, Ore or any product to be screened

The Harrington & King Perforating Company

5650 Fillmore St., Chicago, Ill., U. S. A. **New York Office: 114 Liberty Street**

FOR many plants with surplus stocks of sand and lime, the American Line of Sand-Lime Brick Machinery has proved an important factor in transforming waste to profit. Sand-Lime Brick—made of semi-waste materials—offer unparalleled possibilities for quick profit. Made today—used tomorrow.

Minimum Machinery Requirements
Write for Complete Information



W. A. RIDDELL COMPANY

Bucyrus, Ohio

Formerly Hadfield-Penfield Steel Co.

THE exceptional strength and long wearing qualities of Taylor Chain is common knowledge among power shovel operators everywhere. Over a long period, Taylor Mesaba has consistently shown a capacity to deliver many extra "yards of service" per dollar of chain investment.

Manufactured by

S. G. TAYLOR CHAIN COMPANY

144 S. Dearborn St. Chicago, Illinois

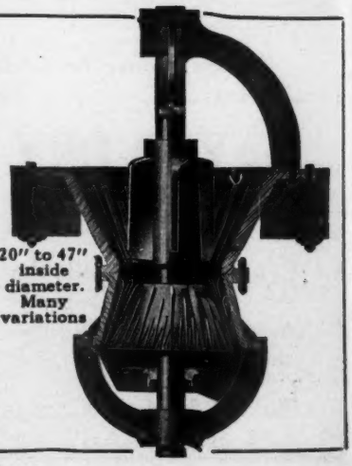
Nippers—17x19", 18x26", 20x30", 24x36" and 26x42"

JAW & ROTARY CRUSHERS

For All Rocks and Ores Softer Than Granite

GYPSUM MACHINERY—We design modern Plaster Mills and make all necessary Machinery, including Kettles, Nippers, Crackers, Buhrs, Screens, Elevators, Shafting, etc.

Special Crusher-Grinders for Lime



20" to 47" inside diameter. Many variations

Butterworth & Lowe

17 Huron St. Grand Rapids, Mich.

DIXON'S
SOLID BELT DRESSING

To Abolish Belt Slip

and to deliver more power to your driven shafting and machinery, apply Dixon's Solid Belt Dressing to every leather, fabric and rubber belt in your plant.

It will keep the belts soft and pliable with a more positive grip on the pulley surfaces over the maximum arc of contact.

A true belt preservative that will greatly increase the life of every belt.

Dixon's Solid Belt Dressing does not harden, cut or clog the belt. Its high efficiency and economy are proved by many years' use in thousands of factories, machine shops and power plants.

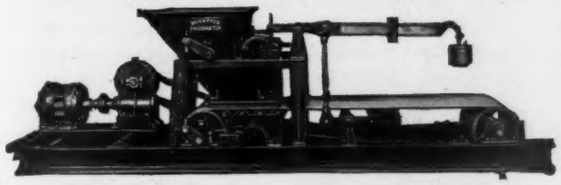
Safe to apply with the belt running at full speed. A little applied at a regular interval is the best way to keep your belts in prime condition continuously.

Handy in size, 2 in. x 8 in. The weight is about 1 lb. Does not deteriorate in storage.

Write for Belt Dressing Circular No. 174-O.

Joseph Dixon Crucible Company
JERSEY CITY, NEW JERSEY
Established 1827

SCHAFFER POIDOMETER



ALMOST HUMAN

Schaffer Poidometers are the mechanical brains of the plant. They are more than that—they are guardians of the quality standards you have set for your product—they prevent waste and assure accuracy and maximum economy.

If you are handling a variety of materials, arrange your Poidometers in batteries—set one for each material and for the proportion wanted—then forget it! The Poidometer will do your bidding better than your most loyal employee. If any machine is not getting its full quota of material, the entire battery will automatically stop. Space does not permit of a thorough explanation of the many cost-saving qualities of Schaffer Poidometers.

WRITE FOR FULL DETAILS

SCHAFFER POIDOMETER CO.
2828 Smallman, Pittsburgh, Pa.

LOCOMOTIVE OHIO CRANE

Steam—Gas—Electric

Hook, Clamshell, Dragline
Magnet or Pile Driver Service

10 to 50 Ton Capacities

The Crane with the 10 Year Guarantee
Catalog on Request

THE OHIO LOCOMOTIVE CRANE CO.
High Street, Bucyrus, Ohio

Meeting Specifications to the Letter

WHENEVER gravel must be washed and screened in order to meet contractors' specifications, the Toepfer Combination Scrubber Screen gives positive assurance of efficiency and low cost in these operations. No matter how strict the specifications, this Toepfer unit will enable you to meet them to the letter.

W. TOEPFER & SONS COMPANY
Milwaukee Wisconsin

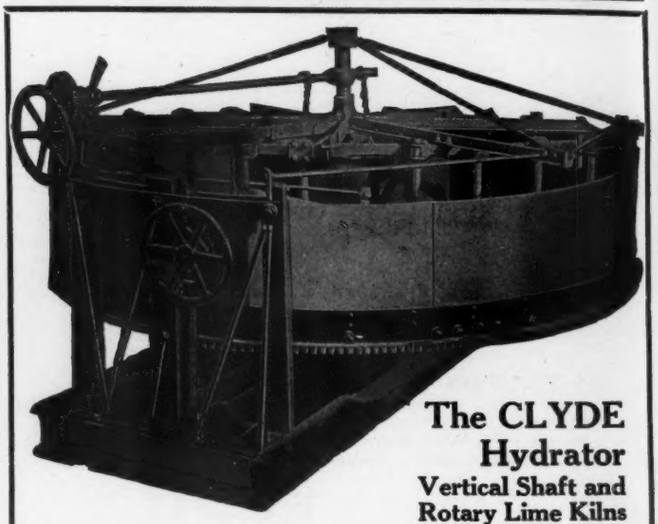
New Type Dust Arrestor

Each bag has individual spring suspension. Shaking is done horizontally, like snapping a rug, flexing material and getting all dust out of cloth. In ten minutes a bag can be replaced and operation resumed.

Patented and Patents Applied for

"Quality Equipment Pays in the End"

THE NEW HAVEN SAND BLAST CO.
New Haven, Conn. Cleveland, Ohio



The CLYDE Hydrator
Vertical Shaft and Rotary Lime Kilns

YEAR after year new developments, new problems, and resultant new improvements spring up in the lime industry. But the Clyde Hydrator seems to "go on forever." It is being constantly improved to keep step with the progress of the industry. And year by year the Clyde retains its leadership as "First in the Field."

H. Miscampbell
Patentee and Sole Manufacturer
Aug. 14, 1923—1464722
Duluth, Minnesota

AFTER THE FIRST YEAR
Comes the Real Test of Crusher Value

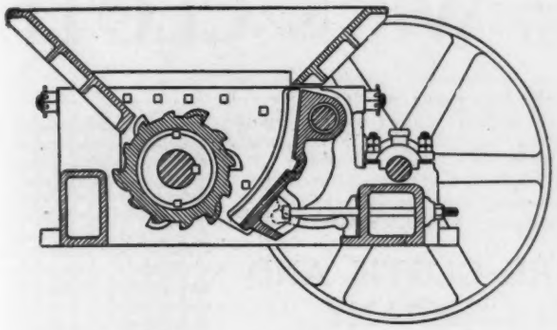
RELIANCE EQUIPMENT

is built of the best materials obtainable for the purpose and guaranteed to stand up under the most severe operating conditions with minimum cost for maintenance.

We Offer Complete CRUSHING, SCREENING and WASHING PLANTS in Any Capacity, from 50 to 1500 Tons per Day

Write for Catalogue and Prices

Universal Road Machinery Co.
Kingston, N. Y.
"RELIANCE"—The Crusher with the Longer Life



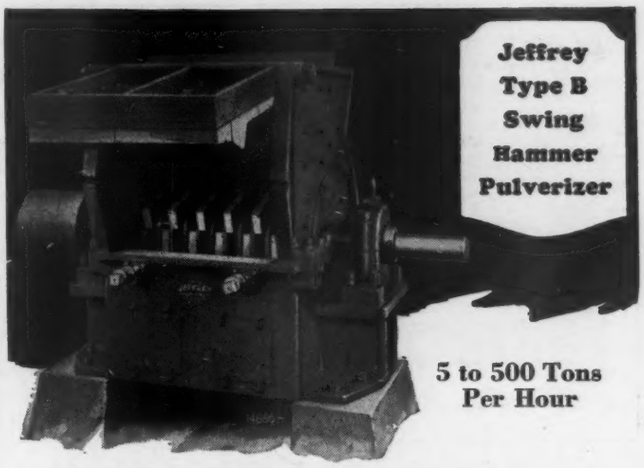
IF you had seen the McLanahan Single Roll Crusher before ordering your first Gyratory or Jaw Crusher you would now be running only the McLanahan Crushers.

After many years' practical experience building and operating other crushers, we brought out the first Single Roll Crusher, proved it best, simplest and most economical—making least fines—requires but little head room—no apron or hand feeding—takes wet or slimy material.

Capacity, 5 to 500 Tons Per Hour

McLanahan-Stone Machine Co.
Hollidaysburg, Pa.

Screens, Elevators, Conveyors, Rock Washers, Etc.



5 to 500 Tons Per Hour

Jeffrey Makes All Sizes of Pulverizers

From the small pulverizer grinding only five tons of crushed stone an hour to the big five hundred ton machine handling lump limestone—Jeffrey makes them all.

Jeffrey Type B Swing Hammer Pulverizers equipped with either oversize ring oiling or ball bearings are heavy duty machines. All working parts are readily accessible.

Catalog 368-C describes Jeffrey Swing Hammer Pulverizers.

The Jeffrey Manufacturing Co.
935-99 N. Fourth St., Columbus, Ohio

Loomis "Clipper" Blast Hole Drills

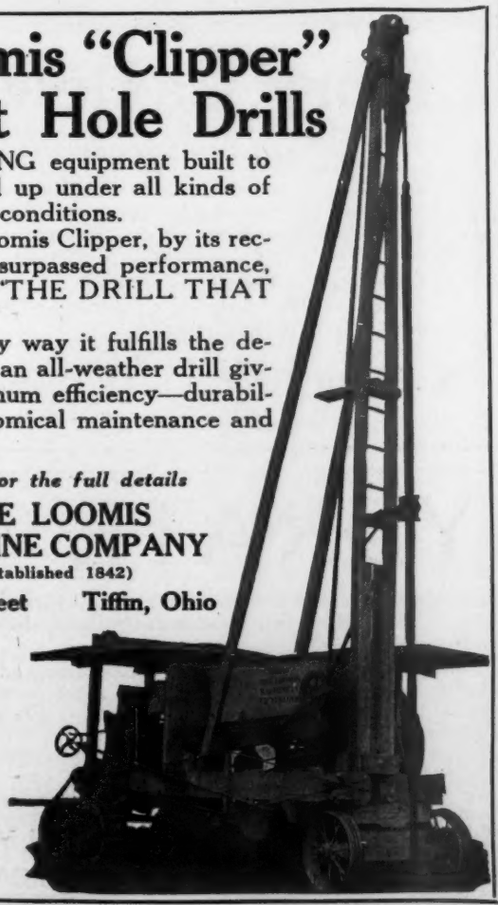
DRILLING equipment built to stand up under all kinds of operating conditions.

The Loomis Clipper, by its record of unsurpassed performance, is called "THE DRILL THAT DRILLS."

In every way it fulfills the demand for an all-weather drill giving maximum efficiency—durability—economical maintenance and operation.

Write for the full details

THE LOOMIS MACHINE COMPANY
(Established 1842)
15 E. Street Tiffin, Ohio



Buckets and Blueprints

AT the back of every bucket is some device or arrangement for fastening said bucket to the belt or chain.

It is not stretching a point to emphasize the importance of placing this device accurately.

Hendrick knows how to follow blueprints. Hendrick buckets fit as intended.

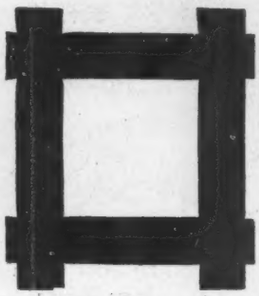
HENDRICK MANUFACTURING CO.
47 Dundaff Street, Carbondale, Pa.

New York Office: 30 Church St.
Pittsburgh Office: 904 Union Trust Building
Hazleton, Pa., Office: 738 West Diamond Ave.

Makers of Mitco Interlocked Steel Grating, Mitco Shur-site Stair Treads and Mitco Armorgrids

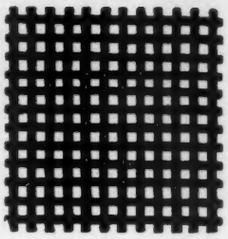
When writing advertisers, please mention ROCK PRODUCTS

"CLEVELAND" DOUBLE CRIMPED WIRE CLOTH



A uniform fineness is assured by the use of "Cleveland" Double Crimped Wire Cloth, making it unequalled for the screening of Sand, Gravel, Crushed Stone and Cement. "Service" is the definite policy of this organization, and through every phase of manufacture this end is constantly before us.

A large stock always on hand. However, any special mesh will be manufactured to suit requirements. PRICES RIGHT.



THE CLEVELAND WIRE CLOTH AND MANUFACTURING COMPANY

1" mesh (¾" opening) ¼" wire 3573 East 78th Street Cleveland, Ohio

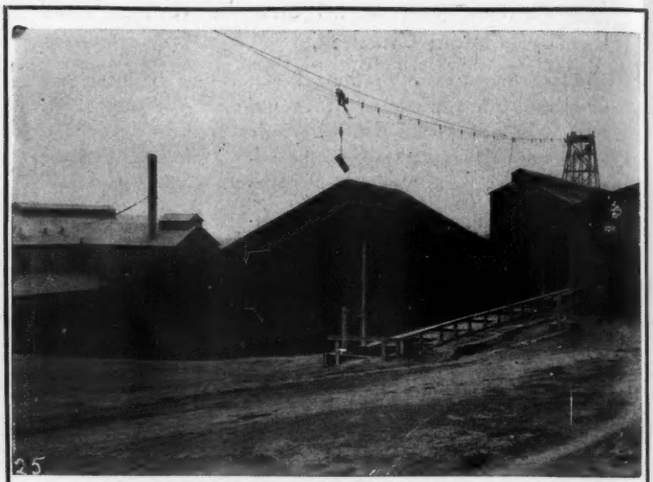
ENGINEERS

Important Economies in Cement Production

A SURVEY of your plant by Ferguson will result in recommendations pointing out important production economies. If you want estimates and suggestions for plant arrangement—constructive ideas on financing or reorganization—investigations and reports on raw materials—money-saving plans for use of standardized methods in construction and equipment, wire, write or phone for a Ferguson executive.

THE H. K. FERGUSON COMPANY
Hanna Building · · · Cleveland, Ohio
Phone: SUperior 3620
New York · Detroit · Birmingham · Tokio, Japan

Ferguson ENGINEERS



Flory Cableways

Flory Cableways furnish dependable and efficient material handling in quarries, construction work, etc. They have correct design, material and workmanship. They are backed by a company that has been building cableways for 50 years. You take no chances when you install a Flory.

Flory also builds Steam, Electric, Gasoline, Belt Driven Hoists; Carpullers; Dredging Machinery; Slate Working Machinery; etc.

S. FLORY MFG. CO., Bangor, Pa.

Sales Agents in Principal Cities

The Kritzer Continuous Lime Hydrator

HYDRATE

Years ago we helped our customers create a demand for their hydrate. Today the demand exceeds the supply. That's why every lime manufacturer should have an efficient, economical hydrating plant.

THE KRITZER Continuous Lime Hydrator is efficient in production and economical in operation and maintenance. Let us investigate exhaustively the local conditions peculiar to your proposition, and then apply our experience of many years and design a plant to meet those conditions.

A KRITZER plant, scientifically adapted to your conditions, will give you the best product at lowest cost

THE KRITZER COMPANY
515 West 35th Street CHICAGO, ILL.

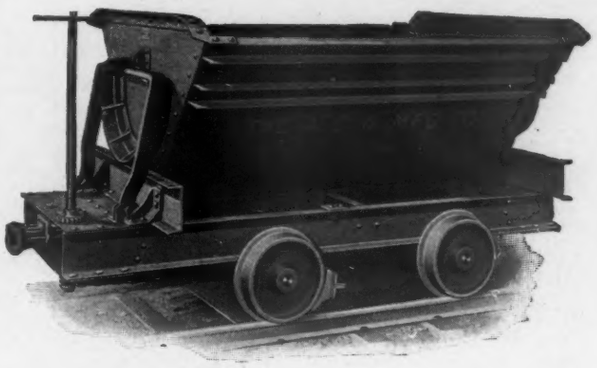
TROCO for Crushers

TROCO Gyratory crusher grease satisfies a long felt want in stone crushing plants and cement mills for a lubricant adapted to the particular requirements of this type of equipment.

Remarkable savings, over any other lubricant ever used for this purpose, have resulted from the use of TROCO in many of the largest crushing plants in the country.

Write for the details of our 60 day FREE TRIAL OFFER. Try TROCO at our expense—with no obligations.

TROCO LUBRICATING COMPANY
Formerly Tredick Oil & Grease Co.
2642-48 N. Mascher St. Philadelphia, Penn.



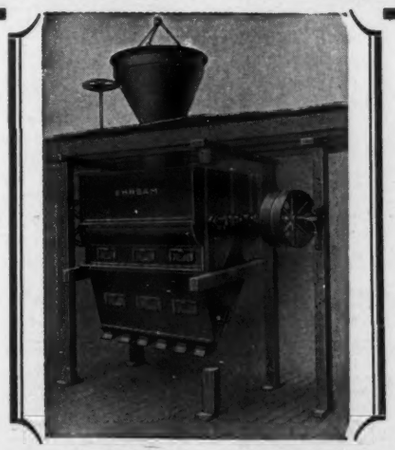
More Than Reinforced

Reinforcing a dump car makes it stronger, of course. But there is a best way to reinforce. Atlas cars are reinforced the best way. Why? Simply because we have built dump cars so long and for so many people that we know just where the reinforcing should go and just how it should be done.

Not much wonder, then, that Atlas dump cars stand the "gaff" better than the average.

The Atlas Car & Manufacturing Co.
ENGINEERS MANUFACTURERS
CLEVELAND, OHIO, U. S. A.

Ehrsam Mixers



EHRSAM Mixers are BUILT RUGGED! That's why they have achieved their reputation for ability to stand up for long periods with a minimum cost for upkeep. First of all, they are **reliable**—and furthermore, they can always be depended upon for absolute uniformity of mix.

Made in various capacities, to meet every operating requirement.

The J. B. Ehrsam & Sons Mfg. Company
Enterprise, Kansas

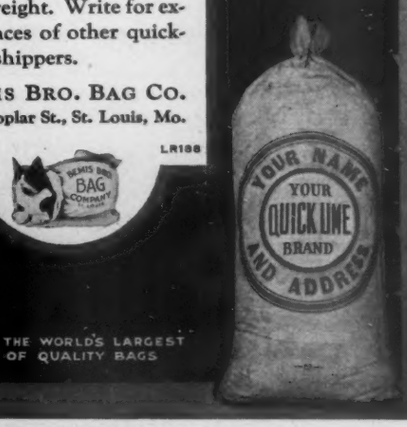
BEMIS WATERPROOF BAGS

Many Savings

First cost of Bemis *Waterproof* Bags is lower than barrels. Much less storage space required; easier to pack and handle; lower tare weight. Write for experiences of other quicklime shippers.

BEMIS BRO. BAG CO.
410 Poplar St., St. Louis, Mo.

LR188



SINCE 1858 THE WORLD'S LARGEST MAKERS OF QUALITY BAGS

1000 to 40,000 Tons

of Material Are Hauled Each Day from Shovels to Crusher

With the Lowest Possible Haulage Cost in Plants Equipped with the

Woodford Haulage System

Operated by One Operator in the Main Control Tower

The Woodford Engineering Company, 77 W. Washington Street, Chicago, Ill.

From Alaska to Florida In Winter and Summer

GREDAG

LUBRICANTS

put a cushion between gear teeth, keep bearing surfaces apart, absorb shocks, resist pressures and prevent wear, without waste of power.

Grades for every purpose. Send for recommendations as made by leading manufacturers of power shovels, cranes, hoists and other material handling equipment.

Gredag contains Acheson Electric Furnace Graphite, 99.9% pure and characterized by its freedom from gritty impurities. It improves all metal surfaces and adds to the ruggedness of the grease body.

Write for fifty page descriptive catalogue, price list and nearest source of supply

ACHESON GRAPHITE COMPANY
Niagara Falls, N. Y.

GRATINGS and SAFETY STEPS

For Industrial, Marine and Architectural Purposes

Write for Catalogue F66E

KERLOW STEEL FLOORING COMPANY
218-224 Culver Avenue Jersey City, New Jersey

Armstrong Bit Dresser

One man, alone, will average dressing ten bits daily!

Whether you operate one Blast Hole Drill or a dozen, the Armstrong Bit Dresser will soon pay for itself in time and labor saved, in reduced costs, in increased production, in added profits. This has been proven in more than 100 quarries and open pit mines. Write for "The Story of the Quarry" and Special Bit Dresser circular.

ARMSTRONG MFG. COMPANY
801 CHESTNUT STREET WATERLOO, IOWA, U. S. A.

Locomotive Cranes and Shovels

Industrial Brownhoist builds a complete line of locomotive cranes ranging in capacity from 7½ to 60 tons and shovels from ½ yd. to 1¼ yds. capacity. Gas, steam, electric or Diesel powered on creeper or railroad truck mountings.

OTHER PRODUCTS

Belt and Chain Conveyors, Bucket Elevators, Bridge Cranes, Clamshell Buckets, Portable Storage Bins.

Industrial Brownhoist Corporation
Cleveland, Ohio

INDUSTRIAL BROWNHOIST

DUSTY OPERATIONS MADE DUSTLESS BY

PANGBORN

Consult us on any phase of Dust Suppression and Collection for any industrial operation.

Pangborn Corporation
Sand-Blast and Dust Suppression Equipment, Hagerstown, Md.

HYMAN-MICHAELS COMPANY
Headquarters for
RAILS
RAILWAY MACHINERY
CARS, ETC.

We Buy and Sell Complete Electric Railway Material and Railway Machinery, New and Relaying Rails, Motors and Turbines
Best Price—Quick Delivery
HYMAN-MICHAELS COMPANY
PEOPLES GAS BUILDING
ST. LOUIS CHICAGO SAN FRANCISCO

PATENT THREE-SPEED TRANSMISSION HOIST

"The Hoist with the Asbestall Frictions"

The Mundy Sales Corporation
30 CHURCH ST., NEW YORK
Agents in Principal Cities

Bollinger-Andrews Construction Co.

Established 1898
Verona, Pa.

STEEL

STRUCTURAL FABRICATORS
ENGINEERS
ERECTORS
WAREHOUSE

LARGE STOCK STRUCTURAL SHAPES

ROBERT W. HUNT CO.

Inspection—Tests—Consultation

Inspection New and Second Hand Machinery, Pumps, Crushers, Steam Shovels, Cars, Locomotives, Rails and Quarry and Contractors' Equipment

INSPECTION AND TESTS OF SAND, GRAVEL, CEMENT, STRUCTURAL STEEL, CASTINGS AND CONSTRUCTION MATERIALS

Cement, Chemical and Physical Testing Laboratories

CHICAGO
2200 Insurance Exchange

New York St. Louis Kansas City Cincinnati Pittsburgh San Francisco

HUM-MER Electric SCREEN

Screens from coarsest to the finest materials either wet or dry
Catalogue sent upon request

The W. S. TYLER COMPANY - Cleveland Ohio.

WOVEN WIRE SCREEN

THE MERRICK CONVEYOR WEIGHTOMETER

Any material which is conveyor-handled can be weighed without additional handling or loss of time by the Merrick Conveyor Weightometer.

An Automatic—Continuous—Accurate Record

MERRICK SCALE MFG. COMPANY
Passaic, N. J.

WILFLEY Centrifugal SAND PUMP
PATENTED
for Slurry

Elimination of stuffing box has done away with many troubles common to centrifugal pumps.

Pump maintains extraordinary efficiency.

Wearing parts unusually heavy, insuring long life.

Cleaning out pump or changing wearing parts requires only a few minutes.

Described and illustrated in our new Catalog No. 6
A. R. Wilfley & Sons, Inc., Denver, Colo., U. S. A.

Perforated Metals—Screens of All Kinds—For Sand, Gravel, Stone, Etc.

MATERIAL IN STOCK
PROMPT SHIPMENT

CHICAGO PERFORATING CO.
2427 to 2445 West 24th Place
Tel. Canal 1459 CHICAGO, ILL.

Rails
New and Relay

also—
FROGS & SWITCHES
SPIKES, BOLTS, TIE PLATES
CROSS TIES, SWITCH TIMBER
ACCESSORIES

Morrison & Risman Co., Inc.
McCormick Bldg. CHICAGO
1437 Bailey Ave. BUFFALO
Warehouses
Buffalo Chicago
Indianapolis
Pittsburgh

Raymond Mills and Pulverizers

for grinding all kinds of materials

The Raymond Bros. Impact Pulverizing Company
1307 North Branch Street
CHICAGO

CROSS ENGINEERING CO. CARBONDALE, PA.
PERFORATED SHEET METALS

Our screens produce a product clean and perfectly sized.
We can supply repair and renewal parts quickly and correctly.
Rush orders can be filled promptly because of our stock of 500 tons or more of steel plates.

Cross Engineering Company
Offices and Works:
Carbondale, Pa.

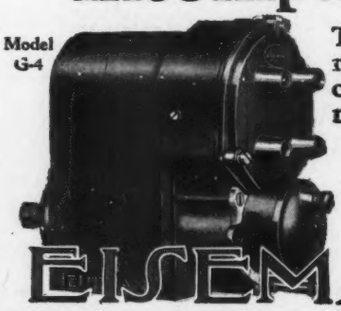
Owen Buckets

GREATER DIGGING POWER
FASTER OPERATION
LONGER LIFE
GUARANTEED AGAINST BREAKAGE
and
"A Mouthful At Every Bite"

THE OWEN BUCKET CO.
6021 BREAKWATER AVENUE CLEVELAND, OHIO

Incomparable

Model G-4

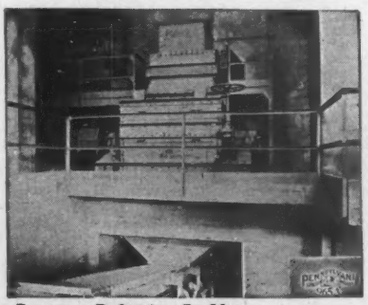


The world's premier magneto. Standard of the construction machinery industry.

EISEMANN

EISEMANN MAGNETO CORPORATION. 165 Broadway, N. Y.

"PENNSYLVANIA" HAMMERMILL



Put your Reduction Problems up to us.

STEELBUILT

preparing Primary Crusher output for pulverizing in one dependable reduction.

UNBREAKABLE STEEL FRAME.

ADJUSTABLE STEEL CAGE.

POSITIVE TRAMP IRON PROTECTION.

50 "Pennsylvania" types and sizes for Primary, Secondary and Finer reductions in cement, lime and gypsum plants.

PENNSYLVANIA CRUSHER COMPANY
Liberty Trust Bldg.
PHILADELPHIA
New York Pittsburgh Chicago

It is part of Rock Products' conception of its duty to readers and subscribers to help them in every possible and legitimate way. The "Situations Vacant" and "Situations Wanted" advertisements are a part of this service. The charges of 2 cents a word, or a minimum charge of a dollar per insertion, are nominal and not designed for profit. Numerous letters from these advertisers assure us of the effectiveness of these advertisements in finding capable men for openings and of finding openings for capable men.

CLASSIFIED ADVERTISEMENTS

POSITIONS WANTED — POSITIONS VACANT
Two cents a word Set in six-point type. Minimum $1.00 each insertion, payable in advance.

INFORMATION
Box numbers in care of our office. An advertising inch is measured vertically in one column. Three columns, thirty inches to the page.

CLASSIFIED—Displayed or undisplayed. Rate per column inch, $4.00. Unless on contract basis, advertisements must be paid for in advance of insertion.

USED EQUIPMENT

MACHINERY FOR SALE

ROTARY CRUSHERS
Three No. 0, Three No. 1, One No. 1½, One No. 2 Sturtevant Rotary Fine Crushers, Three No. 0, One No. 1 Sturtevant Ring Roll Mill, One No. 2 Duplex Sturtevant Ring Roll Mill.

GYRATORY CRUSHERS
All sizes from No. 2 Reduction up to 12K.

JAW CRUSHERS
One 2"x6", Two 7"x10", Two 9"x15", One 6"x20", One 10"x15", One 10"x20", Two 12"x24", One 13"x30", One 15"x36", One 18"x36", One 24"x36", One 22"x50", One 36"x48", One 40"x42", One 60"x84".

CRUSHING ROLLS
One 8"x6", Two 16"x10", Three 30"x10", Two 36"x16", Two 42"x16", One 54"x24", Two 14"x20", and One 24"x12" Crushing Rolls.

DRYERS
One 3'x20', Three 4'x30', One 5'x40', Two 5½'x 40', One 6'x60', One 7'x60', and Two 8'x80' Direct Heat Rotary Dryers, One 5'x25', One 6'x30' Ruggles Coles type "A" and One 4'x 20' Ruggles Coles type "B" Double Shell Rotary Dryers, Three 6'x25' Louisville Dryers.

KILNS
One 4'x40', Two 6'x60', Two 6'x90', One 6'x 100', One 6'x120', One 7½'x80', Three 8'x 125'.

HARDINGE MILLS
Two 3', Three 4½', Three 6' and Two 8' Hardinge Mills.

SWING HAMMER AND TUBE MILLS
Fuller, Griffin and Raymond Mills, Screens, Air Separators, etc.

SPECIAL
One No. 6 Williams Universal Pulverizer.

THE HEINEKEN ENGINEERING CORP.
95 Liberty St. New York City
Telephone Hanover 2450

Rebuilt Dump Cars

20-yard, all steel, Western air dumps. Ten of these.
12-yard, steel underframe, hand dumps. Seven of these.
6-yard, steel underframe, hand dumps. Seven of these.

Rebuilt Locomotives

55-ton Baldwin 6-wheel switcher, separate tender, 200 lb. steam, built 1913.
43-ton Baldwin 6-wheel switcher, separate tender, 180 lb. steam, built 1917.
72-ton American 6-wheel switcher, separate tender, 180 lb. steam. Four duplicates.
42-ton American 4-wheel saddle tank, 180 lb. steam, built 1910.
31-ton Baldwin 4-wheel saddle-tank, built 1914.
21-ton Porter 4-wheel saddle tank, 165 lb. steam, built 1912, 36-in. gauge.

Rebuilt Locomotive Cranes

20-ton Link-Belt 8-wheel 2-line, built 1916.
20-ton Industrial 8-wheel, 2-line, built 1917.
22½-ton Ohio 8-wheel, 2-line, built 1915.

Birmingham Rail & Locomotive Company
Birmingham, Alabama

JAW CRUSHERS

1—30x36.
1—18x36.
1—15x24.
1—10x20.

GYRATORY CRUSHERS

1—No. 5 Austin.
2—No. 6 McCully & Gates.
2—No. 5 McCully & Austin.
1—No. 13 Telsmith.
1—No. 7½ Austin.
1—No. 9K Gates.

SYMONS DISC

1—24" Rebuilt.

HAMMER MILL

1—No. 12 Universal.

CLAM SHELL BUCKET

1—Blaw-Knox 2 yd. cap. Class 620-W, Dreadnought. Used 2 weeks.

A. J. O'NEILL COMPANY
406 Weightman Bldg. Philadelphia, Pa.

In stock 250—24" gauge 2-way Western and Austin dump cars, one and one and one-half yard capacity, in good serviceable second-hand condition. Also a number of new "V" shaped dump cars, 24" gauge: rails, new and relaying and all sorts of tracks supplies of all sections.

Park Row Bldg. New York City **M. K. FRANK** Union Trust Bldg. Pittsburgh, Pa.

Caterpillar Tractors

We offer for sale five brand-new, never used, 5-ton, 55 H.P.

Bear Caterpillar Tractors

There are none better as we have demonstrated on our own work. This is a bargain for new equipment.

ANNVILLE STONE COMPANY
Eighth and Willow Sts. Lebanon, Pa.

FOR SALE

7½-TON ORTON GAS CRANE—40-ft. boom, caterpillar; equal to new; overhauled; genuine bargain; located Chicago.

Address
Box 110, care of Rock Products
542 So. Dearborn St., Chicago, Ill.

500 Tons

30 lb. Rails

Reconditioned

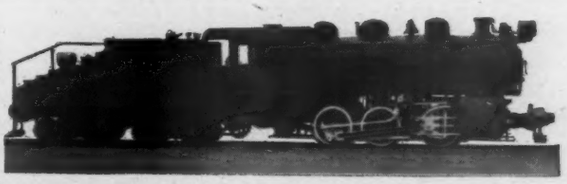
and serviceable as new

Priced to sell now

and all other weights

ZELNICKER IN ST. LOUIS

FOR SALE



75-ton, 21x26 in. American Locomotive Co. 6-Wheel Switcher, BUILT DECEMBER, 1922; piston valve; Walschaert valve gear; Alco power reverse; superheated; tractive power about 36,000 lbs.; steel wheel centers; steel running boards; steel cab; steel tender frame; electric headlights both ends; flexible staybolts. Complies all I. C. C. requirements, etc. READY IMMEDIATE SHIPMENT.
17—16-yd. WESTERN, heavy duty, steel beam type, 2-way dump cars. Some air, some hand dump. Rebuilt with entire new bodies, steel lined floors.
10—20-yd. WESTERN, all steel, two-way air dump cars; vertical air cylinders.
1—50-B Bucyrus Steam Shovel on caterpillars.

HAVE OTHER EQUIPMENT OVERHAULED AND READY
SOUTHERN IRON & EQUIPMENT CO. ***(Est. 1889)*** **ATLANTA, GA.**

CLASSIFIED ADVERTISEMENTS

USED EQUIPMENT

FOR SALE

1—75 H.P. Electric Stripping Outfit.
1—Gas Portable Core Drill.
1—No. 3 Gates Gyratory Crusher with Screens.
1—No. 9-K Gates Gyratory Crusher.
2—No. 8-D Gates Gyratory Crushers.
1—No. 5 Telsmith Gyratory Crusher.
1—No. 7 Williams Fine Grinder.
1—No. 7½-D Gates Gyratory Crusher.
1—18"x36" Farrell Jaw Crusher.
1—36"x48" Traylor Bull Dog Crusher.
1—No. 6 Austin Gyratory Crusher.
2—No. 5-K Gates Crushers.
1—Complete 400 Yard Gravel Plant.
1—Complete Small Stucco Plant.
1—6'x22" Hardinge Conical Ball Mill.
1—41-ton Baldwin Standard Gauge Locomotive.
2—Complete ¾-yd. Gas Cableway Outfits; 1 steam.
1—Sauerman 1-yd. Outfit, without power.
1—Sauerman 2-yd. Electric Outfit, complete.
1—New 200 H.P. G. E. Motor.
1—65' Center Bucket Elevator.
50—Steam and Electric Channelers.
1—33" Fuller Mill.
1—3'x30' Indirect Fired Dryer.
1—42" Gas Whitcomb Locomotive.
1—150' Matthew Gravity Conveyor.

Send us your inquiries and we will send you our offerings from our $15,000,000 Listing.

National Equipment Company
Bloomington, Indiana

CARS

8—12-yd. Std. gage Western Dump.
6—20-yd. Std. gage Western Dump.
30—4-yd. 36" ga. Western Dump.
25—1½-yd. 24" ga. Western Dump.
70—1½-yd. 24" ga. Koppel Steel V Shape.
3—7-ton, 24" ga. Plymouth Gasoline Locos.

BOILERS

2—70-h.p. Brownell Fire Box type, 100-lb.
2—150-h.p. Springfield Scotch Marine, 130-lb.

AIR COMPRESSORS

3—210-ft. Chicago-Pneumatic direct connected to oil engine.

HOISTS

1—7x10 Lidgerwood C.C. D.D.
1—8¼x10 American 3 Drum with boiler.
2—82-h.p. Clyde Single Drum, drum 26"x30".
1—Derrick, steel boom 80-ft., 10 tons with 3-Drum hoist and swinger.

OIL STORAGE TANKS

8—8000-gal. Tank car tanks.
3—25,000-gal. Vertical Round steel tanks.

CRANES, SHOVELS

20-ton Browning 8-wheel loco. crane.
1½-yd. 35-B Bucyrus Steam Cat. Shovel.
No. 5 and 8 Gyratory Crusher.

HYMAN-MICHAELS COMPANY
People Gas Bldg. Chicago, Ill. Railway Exc. Bldg. St. Louis, Mo.

RAILS New and Relay
ALL WEIGHTS AND SECTIONS
FROGS—SWITCHES—TIE PLATES
S. W. LINDHEIMER
38 S. Dearborn St. Chicago, Ill.

USED EQUIPMENT

DRAGLINES FOR SALE

One Bucyrus Class 24 Electric Dragline equipped with 3 ph., 60 cy., 440 v. motors, 100 ft. boom, 4 yd. Dl. bucket, recording meter, 2300 v. to 440 v. transformers, and extra swing and hoist motors. Machine has skid and roller mounting, also self propelling truck mounting.

One Bucyrus Class 14 Steam Dragline with 80 ft. boom, 2 yd. Dl. buckets, new boiler, caterpillar traction.

Both machines overhauled—A1 condition.

CENTRIFUGAL PUMPS

2—American Manganese 15 inch Sand & Gravel Manganese Pumps with 3 ph., 60 cy., 440 v. A.C. motors; 1-500 HP.; others 300 HP.
10—Allis-Chalmers 10 inch, 180 ft. head cap. Water Pumps, direct connected to 3 ph., 60 cy., 2200 v., 200 HP. motors.
1—Morris 12 inch Steam Drive, Water.
3—Morris 8 inch Steam Drive, Sand.
2—Morris 6 inch Steam Drive, Sand.

For prices or information address

The U. G. I. Contracting Co.
Attention: R. C. Stanhope, Jr.
Supervisor of Equipment
U. G. I. Bldg. Philadelphia, Pa.

CRANES

1—25-ton, 8-wheel, OHIO, Model E Locomotive Crane, new 1927, 50 & 60 ft. boom, Bucket operating, like new.
1—15-ton cap. LINK-BELT No. K-2 GASOLINE Crawler Crane, new 1925, 50 ft. Boom, Bucket operating, excellent condition.

SHOVELS

1—ERIE DREADNAUGHT, STEAM Caterpillar, new 1926, one-yard dipper; HIGH LIFT.
1—LORAIN-75, GASOLINE Caterpillar, new 1926, 1¼-yard dipper, HIGH LIFT, like new.

LOCOMOTIVE

1—18x24, standard gauge, PORTER 66-ton, 6-wheel Saddle Tank Locomotive, new 1927, slightly used, like new.

GREY STEEL PRODUCTS COMPANY
111 Broadway New York, N. Y.

FOR SALE

SPECIAL—Gypsum calcining and mixing plant consisting of 4-roll Raymond Mill; 4½x52½ ft. calciner; 4x30 Ruggles-Coles Dryer; 3 Broughton Mixers, Style A-1; A-2, B-1; hair picker; 30 and 36 in. buhrstone mills.
4½x12 ft. Allis-Chalmers Tube Mill.
Raymond Mills, roller and beater type.
8 ft. x 80 ft. single shell dryer.
6x22 and 8x48 Hardinge Mills.
5x30 and 8 ft. 8 in. x 85 ft. Ruggles-Coles Dryers.
Infant, No. 2 and No. 6 Williams Mills.

ROBERT P. KEHOE MACHINERY CO.
7 East 42nd St. New York, N. Y.

FOR SALE—DODGE CRUSHER

Complete with cast steel jaw plate, 7"x9" —used about a year. Manufactured by Allis-Chalmers Co.

CENTRAL SUPPLY HOUSE
41 North Water St. Rochester, N. Y.

USED EQUIPMENT

FOR SALE

24"x36" P. & M. Jaw Crusher.
200 tons 60 lb. Relaying Rails.
1—2"x6" Laboratory Jaw Crusher.
1—Set 36"x30" Smooth Rolls.
1—Set 18"x24" Spike Rolls.
2—10' Morgan Gas Producers.
2—8'x6' Ball Mills.
3—No. 5 McCully Gyratory Crushers.
1—No. 7½ Kennedy Gyratory Crusher.
10—8'x125' Rotary Kilns.
1—9'x100' Rotary Kiln.
1—7½'x80' Rotary Kiln.
10—5'x50' Rotary Coolers or Dryers.

Equipment Sales Company
Richmond, Virginia, and
Benson Mines, N. Y.

FOR SALE
STONE CRUSHING MACHINERY
PRICED FOR QUICK SALE

1—Set Sturtevant Balanced Rolls, 21x11 in.
1—Sturtevant Duplex Steel Jaw Crusher, 6x15 in.
1—Kite Jaw Crusher, 7x16 in.
1—Sturtevant Jaw Crusher, 8x19 in.
1—Williams No. 2 Hammer Mill.
1—Sturtevant No. 2 Rotary Crusher.
1—Champion Jaw Crusher, 9x15 in.
1—Jeffrey Type A Hammer Mill, 30x24 in.
1—Allis-Chalmers Roll Crusher, 24x14 in.
8—6x4 in. Bucket Elevators, 30 ft. centers.
1—Sturtevant 3-Tier Moto Vibro Screen, Type MV, with screw feed.
1—5x6 ft. Trommel Screen.
1—60 H.P. Locomotive Type Boiler, 100 lb. pressure.

Write, wire or phone your inquiries
CONSOLIDATED PRODUCTS CO., Inc.
15 Park Row, New York City Barclay 0603

Machinery For Sale
Immediate Shipment—Attractive Prices

1—5'6"x50' Renneberg Direct Heat Rotary Dryer.
2—7'x7' Gates Ball Mills.
1—4'x16' Smidth Tube Mill, brick lined.
1—No. 6D Gates Gyratory Crusher.
1—5'x22" Hardinge Conical Mill.
1—24"x36", Style D, Jeffrey Hammer Mill.
3—Sets 20x14" Sturtevant Granulating Rolls.
1—Set 36x16" Sturtevant Balanced Rolls.

If you don't see what you require—inquire

UNITED UTILITIES, Inc.
17 W. 60th Street New York City

UNIVERSAL CRUSHER COMPANY
Eastern Agents

All Steel Jaw Crushers. Also used equipment in crushing and power lines.

HOOPER-MOMBERGER CO.
90 West St., New York City Phone Rector 2919

Bargain Prices
100,000 Lbs. Capacity
ALL STEEL ORE HOPPER DUMP CARS
MCB condition. Ready for service.
Cheap freight to any part U. S. A.
DULUTH IRON & METAL COMPANY
Duluth, Minn.

CLASSIFIED ADVERTISEMENTS

USED EQUIPMENT

FOR SALE

One Mead-Morrison two yard Dragline Hoist, 100 HP. Lincoln motor, 3-phase, 60-cycle, 220 volts. Used in the production of only 200,000 tons of material.

SCULLY SAND AND GRAVEL CO.
118 First Street Cambridge, Mass.

FOR SALE

24—All-steel, standard gauge 4-yard end dump Koppel quarry cars.

North Shore Material Company
Libertyville, Ill.

FOR SALE

Owing to change of equipment at our plant we offer for sale—One 8-in. Amsco pump, direct connected to Twin City gas engine. Mounted complete on steel frame. This unit is floated on a 5-section wood barge, 18x25 ft.

SPICER GRAVEL CO. Marseilles, Ill.

Priced Right for Quick Sale

42x36 Kennedy Jaw Crusher. All-steel Bucket Elevator, centers 60 ft. Buckets 26x23x17.

PIEDMONT CORPORATION
Chestatee, Ga.

MACHINERY FOR SALE

8—4-yd. 36" gauge, wood side dump cars.
1—4-ton 36" gauge Milwaukee Gas Locomotive.
1—7-ton 36" gauge Plymouth Gas Locomotive.
1—Thomas 2-speed hoist with motor.
1—1½-yd. Class X Sauerman bucket and carrier assembly.
1—1½-yd. Pioneer Drag Cable bucket.

COON RIVER SAND COMPANY
Des Moines, Iowa

USED EQUIPMENT WANTED

WANTED TO BUY

Gas Producer with capacity to gasify 30 to 40 tons bituminous coal per 24 hours. Please give name of make, its rated capacity, mechanical condition and lowest price.

Longview Lime Works, Longview, Ala.

WANTED

Plymouth Gasoline Dinky, 7 or 8 tons, 24" or 30" gauge; 30" preferred. 24" Belt Conveyor Carriers. 21x36 McLanahan Crusher. State full particulars and prices.

CEDAR RIDGE LIMESTONE QUARRY
Hollidaysburg Pennsylvania

Wanted for Immediate Delivery

1—No. 4 Eight inch
1—No. 5 Ten inch
1—No. 6 Twelve inch Gyratory Crushers.

Must be in good condition and preferably Central States location. Write or wire description, location and price.

BOEHCK MACHINERY COMPANY, Inc.
2404 Clybourn Street Milwaukee, Wisconsin

BUSINESS OPPORTUNITIES

Crushing, Grinding, Washing Plant

Location North Carolina. Bin Crusher Feeder, Crusher, Crushing Rolls, Tube Mill, Classifier, Thickener, Tanks, Pumps, Pipe, Filters, etc.

Box 33, West Cummington, Mass.

PARTNER WANTED

Sand lime brick plant, building of steel frame and brick, unlimited amount of pure silica sand, make a fine hard brick, all machinery ready to run, cheap labor. No brick plant nearer than 80 miles. Albany alone uses a good many millions of brick each year.

ALBANY BRICK CO., Albany, Ga.

FOR SALE OR ROYALTY

Sand and gravel pit, also silica sands, two miles east of Lodi, O. Railroad on each side pit; running water for washing sands; electricity available; very light overburden, convenient to load. Stands test at Columbus, O. Correspondence invited. Address

G. W. Hantz Seville, O., No. 2

WANTED

Man with some capital to invest in crushing plant.

Address Box 114, care of Rock Products
542 South Dearborn St. Chicago, Ill.

SITUATIONS WANTED

PACIFIC COAST SALES ENGINEER AND district manager wishes to affiliate with a live organization supplying machinery or equipment to cement, plaster, lime and grinding plants, having held a position as Pacific Coast Manager with a well known organization in Chicago for seven years. Desires to make change. Is in personal touch with all the operators and executives in this territory from El Paso, Texas, to Edmonton, Canada, including Denver. Thoroughly familiar with all plant operations. Address Box 2271, care of Rock Products, 542 So. Dearborn St., Chicago, Ill.

AVAILABLE, YOUNG MAN WITH BROAD experience as production clerk and assistant superintendent wishes to make permanent connection with company that will recognize executive ability in the handling of plant shipments, payrolls, operating costs, books and correspondence. Familiar with all phases of crushed stone industry. An adaptable and energetic hustler that can assure efficient results. Address Box 96, care of Rock Products, 542 So. Dearborn Street, Chicago, Ill.

CONNECTION WANTED BY A QUARRY superintendent of sixteen years' experience in the operation of large quarries. Conversant with the detail of design and economical operation of quarry, crushing plant, etc. Practical knowledge of electricity and various methods of blasting. More interested in good connection than large salary. Will guarantee maximum production at low cost with equipment available. Reference from past connections. Adress Box 95, care of Rock Products, 542 So. Dearborn St., Chicago, Ill.

WANTED—A POSITION AS SUPERINTENdent of lime plant. Eighteen years experience; familiar with most all kinds of kilns, fuel and hydrating systems; now employed but desire change for good reason. Available 30 days after acceptance of other position. Would consider foremanship of any department where promotion would be based on results obtained. Address Box 109, care of Rock Products, 542 So. Dearborn St., Chicago, Ill.

SITUATIONS WANTED

POSITION DESIRED BY SUPERINTENdent qualified through long experience to successfully handle any crushed stone or gravel operation. Thoroughly familiar with every phase of the business, including plant design and construction. Dependable and practical supervision given the work at all times. Several years experience in extensive production of hard rock. Locate anywhere. Satisfactory references. Address Box 104, care of Rock Products, 542 So. Dearborn St., Chicago, Ill.

SUPERINTENDENT, 20 YEARS PRACTICAL experience in construction operation and maintenance of rock crushing, washing and pulverizing plants. Competent quarry and pit operation. Thoroughly experienced with all types mill and quarry machines, auxiliaries and power equipment. Efficient material handling and organizing of operating crew. Available now. A1 references. Address Box 105, care of Rock Products, 542 South Dearborn Street, Chicago, Ill.

WANTED—POSITION AS CHIEF CHEMist in cement plant. Have had broad experience in the cement industry with 18 years actual operation. Thorough knowledge of quarry and mill supervision, burning with oil or coal, wet or dry process. Age 37 and married. Can furnish complete record with best of reference. Address Box 100, care of Rock Products, 542 South Dearborn Street, Chicago, Ill.

SUPERINTENDENT—DESIRES ENGAGEment; thoroughly familiar with stone crushing, sand and gravel operations; competent and efficient operator; location South or West. Prefer working on bonus basis or tonnage contract. Excellent references. Address Box 99, care of Rock Products, 542 South Dearborn Street, Chicago, Ill.

ENGINEER, EXPERIENCED IN DESIGN, construction and operation; cement, lime, crushing, pulverizing, conveying, ore handling and treating plants. Considerable experience in other industrial manufacturing lines. Address Box 2253, care of Rock Products, 542 South Dearborn St., Chicago, Ill.

WANTED—POSITION AS SALES REPREsentative or Sales Manager with a portland cement manufacturer or high grade clay products manufacturer. Experienced and thoroughly capable. Will consider other lines. Address Box 113, care of Rock Products, 542 South Dearborn St., Chicago, Ill.

SUPERINTENDENT—15 YEARS EXPERIence in charge of limestone mines, quarries and lime burning plants. Executive ability and experienced in plant design and construction, mine and quarry development. Address Box 112, care of Rock Products, 542 So. Dearborn St., Chicago, Ill.

SITUATIONS VACANT

MANUFACTURER OF COMPOSITION, ALSO cast stone fireplaces, desires man with large experience in both wet and dry process. Wonderful opportunity for a man who has the following qualifications: An organizer; able to handle men, practical knowledge of the reaction of chemicals; carry out experiments, work up own designs and supervise modeling. In fact, handle this Department of a growing concern. Must be able to furnish best of references. Address Box 102, care of Rock Products, 542 So. Dearborn St., Chicago.

SALESMAN—HIGH GRADE YOUNG MAN with knowledge of crushed stone and gravel operation, with some selling experience, willing to make one to three week trips in Central and Southern territory. Write us your experience and any other information. Address Box 111, care of Rock Products, 542 So. Dearborn St., Chicago, Ill.

Situation Vacant

Employers seeking good help can secure it by inserting an advertisement in this department.

UNIVERSAL STEEL CRUSHERS

The ideal crusher for quarry rock or oversize gravel. Do with one UNIVERSAL what often requires two crushers of any other type. Big feed opening and large reduction to small sizes for road surfacing or concrete construction. Force feed action of the movable jaw insures maximum capacity. Simplicity of design and manganese equipment insure easy operation, long life and low cost per ton of output. Thousands of owners throughout the U. S. are consistent boosters. Let us tell you where you can see a Universal at work.

Six large opening crushers with capacities to 450 tons per day.

Six sizes for rejections and oversize gravel.

Either stationary or portable with or without elevators and screens.

Write for complete information

UNIVERSAL CRUSHER CO. 617 C AVENUE WEST CEDAR RAPIDS, IOWA

INDEX TO ADVERTISEMENTS

A

Acheson Graphite Co. 154
Allis-Chalmers Mfg. Co. 113
Alloy Steel & Metals Co. 28
American Manganese Steel Co. 123
Armstrong Mfg. Co. 154
Atlas Car & Mfg. Co. 153
Austin Mfg. Co. 27

B

Beaumont, R. H., & Co. 132
Bemis Bro. Bag Co. 153
Bethlehem Steel Co. 35
Bollinger-Andrews Const. Co. 155
Bonnot Company 114
Bowser, S. F., & Co., Inc. 143
Bradley Pulverizer Co. 144
Broderick & Bascom Rope Co. 20
Browning Crane Co. 37
Bucyrus-Erie Co. 8
Buda Company 31
Burrell Eng. & Const. Co. 144
Butterworth & Lowe 148
Byers Machine Co. 120-121

C

Caterpillar Tractor Co. 16
Chain Belt Co. 48
Chicago Perforating Co. 156
Classified Advertising 157-158-159
Classified Directory of Advertisers 124-126-128-130
Cleveland Crane & Eng. Co. 39
Cleveland Wire Cloth & Mfg. Co. 152
Cleveland Worm & Gear Co. 26
Climax Engineering Co. 118
Consolidated Concrete Mach. Corp. 115
Cook's Sons, Adam, Inc. 147
Cross Engineering Co. 156

D

De Laval Steam Turbine Co. 141
Dixie Machinery Mfg. Co. 142
Dixon, Jos., Crucible Co. 149
Dobbie Foundry & Mach. Co. 43
Dorr Co. 6
Dust Recovering & Conveying Systems 38

E

Easton Car & Construction Co. 10
Ehrsam, J. B., & Sons Mfg. Co. 153
Eisemann Magneto Corp. 156
Electro Metallurgical Sales Corp. 24

F

Fate-Root-Heath Co. 41
Ferguson, H. K., Co. 152
Flory, S., Mfg. Co. 155
Fuller Co. 127
Fuller Lehigh Co. 40

G

Galland-Henning Mfg. Co. 140
Gay, Rubert M., Co. 147
General Electric Co. 30
General Refractories Co. 141
Goodrich, B. F., Rubber Co. Insert between 4 & 5
Goodyear Tire & Rubber Co. 15
Green, L. P. 131
Gruendler Pat. Crusher & Pulv. Co. 140

H

Hardinge Company 3
Harnischfeger Corp. 29
Harrington & King Perf. Co. 148
Hayward Company 33
Hendrick Mfg. Co. 151
Hercules Motors Corp. Front Cover
Hercules Powder Co., Inc. 21
Hetherington & Berner Inside Back Cover
Horsburgh & Scott Co. 142
Hunt, Robert W., & Co. 155
Huron Industries, Inc. 36
Hyatt Roller Bearing Co. 11
Hyman-Michaels Co. 155

I

Industrial Brownhoist Corp. 154
Insley Mfg. Co. 117
Interstate Equipment Corp. 154

J

Jackson & Church Co. 139
Jaite Company. Inside Back Cover
Jeffrey Mfg. Co. 151

K

Kent Mill Co. 138
Kentucky Wagon Mfg. Co., Inc. 139
Kerlow Steel Flooring Co. 154
Koehring Co. 49
Komnick Machinery Co. 147
Kritzer Company 152

L

Le Roi Company. Back Cover
Leschen, A., & Sons Rope Co. Inside Back Cover
Lima Locomotive Works. 138
Link-Belt Co. 9 & 47
Longyear, E. J., Co. 46
Loomis Machine Co. 151
Ludlow-Saylor Wire Co. Insert between 16-17

M

Mackintosh-Hemphill Co. 137
Magnetic Mfg. Co. Inside Front Cover
Manganese Steel Forge Co. 32
Manitowoc Engineering Works. 125
McGann Mfg. Co., Inc. 137
McLanahan Stone Machine Co. 151
Merco Nordstrom Valve Co. Insert between 4 & 5
Merrick Scale Mfg. Co. 153
Miscampbell, H. 150
Monighan Machine Co. 7
Morrison & Risman Co., Inc. 156
Mundy Sales Corp. 43 & 155

N

New Haven Sand Blast Co. 150
Northern Engineering Works. 147
Novo Engine Co. 44
Nuttall, R. D., Co. 132

O

Ohio Locomotive Crane Co. 149
Orville Simpson Co. 1
Owen Bucket Co. 156
Oxweld Acetylene Co. 12

P

Page Engineering Co. 14
Pangborn Corp. 155
Penberthy Injector Co. 149
Pennsylvania Crusher Co. 156
Pennsylvania Pump & Compressor Co. 136
Philadelphia Gear Works. 135
Pierce Governor Co. 122
Plymouth Locomotive Works. 41
Polysius Corp. 146
Power Mfg. Co. 145
Prest-O-Lite Co., Inc. 13
Prest-O-Weld 4

R

Raymond Bros. Impact Pulverizer Co. 156
Riddell, W. A., Co. 148
Robins Conveying Belt Co. 119
Roebling's, John A., Sons Co. 146
Ruggles-Coles Engineering Divn. of the Hardinge Co., Inc. 3

S

Sauerman Bros., Inc. 129
Schaffer Poidometer Co. 149
Simplicity Engineering Co. 143
Simpson, Orville Co. 1
Sly, W. W., Mfg. Co. 19
Smidth, F. L., & Co. 133, 135
Smith Engineering Works. 17
Stearns Conveyor Co. 48
Stephens-Adamson Co. 45
Sturtevant Mill Co. 34
Sullivan Machinery Co. 145
Symons Bros. Co. 22-23

T

Taylor, S. G., Chain Co. 148
Thew Shovel Co. 25
Toepfer, W., Sons Co. 150
Traylor Eng. & Mfg. Co. 116
Troco Lubricating Co., Inc. 153
Tyler, W. S., Co. 155

U

Universal Crusher Co. 160
Universal Road Machinery Co. 150
Universal Vibrating Screen Co. 134
Used Equipment 157-158-159

V

Vulcan Iron Works. 18

W

Webster Mfg. Co. 133
Welch, F. M., Engineering Service 134
Wilfley, A. R., & Sons 155
Wisconsin Motor Mfg. Co. 5
Wood, R. D., & Co. 136
Woodford Engineering Co. 154